COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

Ninth Annual Report of the Sugarcane Research Station, for the year 1938.

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The Botanist.

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Mr. F. N. Coombes, Mr. P. Langlois — Nominated by the Advisory Board of the Agricultural College.

Ninth Annual Report of the Sugarcane Research Station, for the Year 1938.

INTRODUCTION

By the Officer in Charge

During the year under review, the staff of the Station has again been brought up to full strength by the appointment of Mr. G. C. Stevenson, formerly Assistant Botanist of the B. W. I. Sugar Cane Breeding Station, to the post of Geneticist, the appointment dating from 1st July, 1938. This officer arrived in the Colony on July 27th and assumed duty the following day. Mr. S. Dupont de Rivals St. Antoine was also appointed as an extra field assistant for cultural and manurial experiments on 1st May, 1938. On account of pressure of work in other directions, the services of the Agronomist have not been available at all during the year under review.

Mr. N. Craig, who had been Acting Geneticist, reverted to his substantive post of Senior Chemist on the arrival of the Geneticist and was appointed Officer in Charge of the Station.

Two meetings of the Research Advisory Committee of the Sugarcane Research Station have been held during the year, one in April at which the Annual Report for 1937 and the programmes of research for 1938 were discussed, and the other in August, when a visit to Pamplemousses Experiment Station was made to see the actual work in progress.

In consequence of the Report of the Commission of Enquiry into the Unrest on Sugar Estates in Mauritius, 1937, and at the request of H. E. The Governor, the Acting Director of Agriculture appointed a Committee to enquire into the possibility of purchase of Planters' canes on a quality basis. The Senior Chemist was appointed to this Committee which held fourteen meetings during the year, without arriving at any definite conclusion. At the last meeting of this committee, a small sub-committee consisting of the Director of Agriculture, Sugar Technologist and Senior Chemist, was appointed to interview the Managers of factories receiving planters' canes, and also middlemen and representative small planters, in order to try to find a solution which would be equitable to all parties. This sub-committee has visited 31 factories during the year under review. The Senior Chemist was also appointed to two other sub-committees, one to deal with the purely technical aspect of determining the sugar value of planters' canes and the second to enquire into the question of the low grade Uba de Rich Fund varieties which are grown on an extensive scale in the neighbourhood of St Julien and Bon Accueil, Belvédère, etc., the object of this sub-committee being to make suggestions for (a) the readjustment of the price to be paid for these varieties and (b) the replacement of Uba de Rich Fund canes by other varieties of higher grade. The whole area was visited by the committee to study the question on the spot and it is hoped to submit a report early in 1939.

Three scientific assistants of the Sugarcane Research Station visited all estates with mills, to map as far as possible the areas planted with sugarcane by (a) Estates with mills, (b) Estates without mills and Big Planters, and (c) Small Planters. At the same time information was collected with respect to the varieties cultivated by each category of planters, and also about the method of manuring and fertilising adopted by each.

As will be seen in the section written by the Geneticist, weather conditions during 1938 were not ideal for the growth of the sugarcane crop, although conditions for ripening in the later part of the year were excellent. The 1938 crop got a good start due to early rains in October and November 1937, but this was followed by two very dry months in December 1937 and January 1938. In spite of this, however, a record crop was reaped, and this is probably due to (a) high extraction due to the good ripening season, (b) extension of area under sugar cane, (c) improved cultural methods, (d) improved varieties.

The popularity of three of the varieties released by the Sugarcane Research Station, viz M. 171/30, M. 72/31 and M. 134/32 still seems to be on the increase, and it seems likely that a fair amount of these canes may be sent to the factory during the coming crop.

In all, seven demonstration plots have been planted in the St Julien and Lallmatie areas, with the objects of finding varieties to replace the Uba canes which are at present being grown, and also to demonstrate the effect of phosphatic fertilisers. In two plots reaped in 1938, the application of phosphatic guano resulted in an increase of over 30%, and it is gratifying to be able to record that many small planters are beginning to use this fertiliser. Some 12,000 to 15,000 cuttings of M. 27/16 were distributed to members of Lallmatie and New Eastern Bon Accueil C.C.S., for trial in this area, and the requisite amount of phosphatic guano was supplied by the Society to apply at the rate of 200 kgs per arpent.

The Mauritius College of Agriculture and the Sugar Industry Reserve Fund of the Chamber of Agriculture contributed Rs. 18,000, and Rs. 10,000 respectively, towards the cost of the Station, and in addition the latter body have accepted to defray one-half of the salaries and travelling expenses of the two extra Field Assistants.

Satisfactory progress has been made with the research programmes of all divisions and I desire to place on record my appreciation of the efforts made by all officers of the Station.

PART I—CANE-BREEDING

BY G. C. STEVENSON

INTRODUCTION

The writer arrived in the Colony on July 27th, 1938, and assumed duties on the following day. By this time, the greater part of the breeding work was finished for the season, and large numbers of seedlings were already established in boxes. Since Mr. A. G. G. Hill left the Colony, on February 6th, 1937, the work of the division had been carried out under the direction of Mr. N. Craig, Senior Chemist. It is desired to place on record, at the outset, the writer's appreciation of the work of this officer, and that of Mr. A. de Sornay, Cane Breeding Officer, and Mr. G. Mazery, Scientific Assistant, during the period when the post of Geneticist was vacant. It is felt that any progress which may be made in future has been greatly facilitated by the work done during this period.

I.—CANE BREEDING—M/38 SERIES

The breeding work was carried out, as in previous years, both at the Central Experiment Station, Reduit, and at Pamplemousses Experiment Station, from May to August 1938. At both places conditions were favourable for hybridisation and seed setting, and the germinations were well up to the standard of former years, with the result that a satisfactory population of seedlings is available for subsequent trials as the M/38 series.

In all, 97 distinct crosses were made at C.E.S., and 99 at P.E.S. These may be summarised as follows :—

	C.E.S.	P.E.S.
(*a*) Crosses between noble varieties (*S. officinarum*) ...	15	7
(*b*) Nobilisation of *S. spontaneum*, "Glagah" :		
1. second nobilisation	2	3
2. third nobilisation	4	6
3. fourth nobilisation	17	21
4. fifth nobilisation	25	16
(*c*) Nobilisation of *S. barberi* "Chunnee":		
1. first nobilisation	1	0
2. second nobilisation	1	1
(*d*) Crosses involving blood of *S. sinense* ...	1	6
(*e*) Other crosses	13	31
(*f*) Selfings	0	7
(*g*) Intergeneric cross	0	1
Totals : ...	97	99

Included in section (e) above are crosses involving the blood of Uba Marot, a thin, vigorous cane of unknown origin, and of Selangor Seedling, a variety originally introduced from Java, which is probably a seedling of P.O.J. 2878. Also included in this section are crosses between varieties representing various stages in the Glagah blood line, which cannot be classified as definite nobilisations,

A complete list of the crosses made, and of the seedlings produced, is presented in Appendix I.

II—SEEDLINGS RAISING AND PLANTING OUT—M/38 SERIES

The noble cane crosses proved to be moderately fertile, except in the case of those crosses involving Black Tanna, which produced very few seedlings. This latter variety was used as female parent in no fewer than twenty crossses with male varieties of widely differing derivation in the hope of raising an adequate population of seedlings for testing purposes. In each case, however, fertility was very low, and less than forty seedlings were produced from these crosses. In the *S. barberi* and *S. sinense* nobilisations, germination was also very poor. The most prolific crosses were certain of the glagah nobilisations, and some crosses involving the blood of nobilised glagah and Uba Marot types.

The selfings at P.E.S. were carried out for the purpose of testing certain varieties for use as parents. No selfed seedlings were planted in the field.

Approximately 26,500 seedlings were obtained at the Central Experiment Station, and 43,000 at Pamplemousses Experiment Station.

As in previous years, seedlings were first grown in boxes, and subsequently transferred to pots made from cane trash during August, September and October. The bulk of the field planting was done during November and December, though at the Central Experiment Station this operation was held up by the unusually dry weather, and extended into January, 1939.

The field plantings were allocated as shown in the following summarised table, details of which are given in Appendix I :—

	C.E.S.	P.E.S.
Noble varieties ...	915	753
Glagah 2nd nobilisation	60	11
„ 3rd „	785	1,184
„ 4th „	651	1,801
„ 5th „	1,403	861
Chunnee 2nd nobilisation	0	7
Uba crosses ...	60	70
Other crosses ...	3,349	2,008
Totals	7,223	6,695

III.—FIRST YEAR TRIALS—M/37 SERIES

These seedlings were bred in 1937, and planted in the field at the end of same year. They were selected at the Central Experiment Station and Pamplemousses Experiment Station during November and December 1938. The number of seedlings in these trials, and the numbers selected at each station, are shown in the following brief summary :—

	No. in trials	No selected	Selection o/o
C.E.S. ...	11,892	108	0.9
P.E.S. ...	9,951	115	1.2
Totals ...	21,843	223	1.0

Analyses of the selection figures at both stations were made in order to evaluate the crosses on a basis of population performance, and the best crosses from which adequate populations were available are tabulated below :—

Cross			Station	Selection %
M. 134/32	×	M. 23/16	C.E.S.	4.2
POJ. 2878	×	M. 24/25	P.E S.	3.0
R.P. 6	×	M. 27/16	P.E.S.	2.6
M. 134/32	×	M. 27/16	C.E.S.	2.6
R.P. 6	×	M. 72/31	C.E.S.	2.3
M. 134/32	×	M. 72/31	C.E.S.	2.2
Selangor Seedling	×	M. 196/31	C.E.S.	2.2
M. 134/32	×	M. 27/16	P.E.S.	2.2
Selangor Seedling	×	M. 108/30	P.E.S.	2.1
M. 1/17	×	M. 72/31	C.E·S.	2.1
M. 188/33	×	Selangor Seedling	P.E.S.	2.0
Selangor Seedling	×	M. 196/31	P.E.S.	2.0
55.P	×	Selangor Seedling	P.E.S.	2.0
M. 13/30	×	POJ. 2878	C.E.S.	2.0

This analysis of progeny performances will be consulted in formulating future breeding programmes, with the object of raising the general level of the first year seedling populations. Certain crosses which give low selection percentages will be discarded.

It will be noted that certain varieties have been used in the breeding work both as male and as female parents. Cases in point are POJ. 2878 and Selangor Seedling, both of which shed an appreciable amount of pollen under normal circumstances. Large numbers of selfed seedlings must be expected to occur in populations from such varieties when used as female parents, and were in fact seen during the selection work at both Stations. Precise evaluation of crosses under such circumstances cannot be attempted, and for this reason it is felt that, except in special cases, male-sterile varieties only should be used as female parents. While it is admitted that some promising seedlings have been produced from crosses involving a pollen-shedding female parent, it is felt that, in a science where real progress can only be made by reducing the empirical nature of the work, any schemes dependant on hit-or-miss methods should be, as far as possible, eliminated.

All selected seedlings were planted in multiplication plots, in order to provide adequate planting material for second year trials. These multiplication plots also allow of a minor selection being made, provided growing conditions are good, before the seedlings are allocated to the second year trials.

Owing to the poor growth made by the 1939 series of seedlings at both stations, selections were not made in 1937, but in January and February 1938, before the writer arrived in the Colony. Of this series 153 seedlings were selected from a total population of 10,804, or approximately 1.4% at the Central Experiment Station, and 77 seedlings from a population of 7,756, or 1.0% at Pamplemousses Experiment Station. All selections were planted in multiplication plots, from which the seedlings at P.E.S. were planted in second year trials in October 1938 (see section IV below), while those at the C.E.S. having made poorer growth, were not included in second year trials during the year under review.

In selecting seedlings for further trial from a large first year population, the most important features which are considered are the following :—weight, richness of juice as indicated by the hand refractometer, and general appearance, which includes such features as habit, vigour, and degree of arrowing. In view, however, of the common fallacy that a consideration of these features alone—or even in conjunction with observations on apparent resistance to drought, diseases and insect pests, which must eventually be taken into account—is sufficient to reveal the best seedlings in a first year population of several thousands, certain other aspects of the selection procedure are felt to be pertinent. These are considered below.

It is well known that, in any *one variety*, the yields of *single stools* show a wide range. Consequently, as in the first year trial each seedling is represented by a single stool, it follows that these stools need not necessarily represent the average for the seedlings when grown on a larger scale. Further, it is natural that first year seedlings selected on a basis of weight should, in subsequent trials, give a poorer performance on a weight-per-stool basis. This was shown by Hill in 1935*, and represents a source of error in selection work which appears to have no practical means of elimination.

Inequalities in soil fertility are bound to occur over large blocks of experimental land, also a sporadic distribution of pests and diseases, and mutual antagonism of adjacent seedlings, the effect of which cannot be accurately estimated. These and other factors may have profound influence

*S.R.S. Bulletin 8, 1935.

on the genotypic expression of the seedlings under trial, and a realization of the circumstances puts the selector in an analogous position to that of Alice in Wonderland, who "soon came to the conclusion that it was a very difficult game indeed."

First year seedlings from particular parentages are, of necessity, planted at random in the field, and it is therefore reasonable to assume that the best types show a random distribution over the block. It follows, therefore, that ultimate selections from several *restricted areas* will include a high proportion of the best types in the whole population. It is by the use of such selection methods that the effects of soil fertility variation and the sporadic distribution of pests can be minimised. Moreover, the weights of seedlings of similar type (e.g. noble canes) selected in this way have been shown to exhibit a high positive correlation with their weights in subsequent second year trials*. Correlations of the same degree of magnitude are not to be expected where the performances of selections from entire first year populations, including seedlings from a wide range of parental material, are compared with their behaviour in the second year trials. That this is so was clearly demonstrated by Hill in the publication referred to above,

The above considerations were borne in mind in making the first year selections, and continued attention will be paid to the problem of increasing the reliability of this important phase of seedling testing.

IV—SECOND YEAR TRIALS

Six second year trials were planted in October at Pamplemousses Experiment Station. Each included nine seedlings and a standard variety. The seedlings were allocated to distinct trials according to type, on the basis of parentage and growth vigour. The standard varieties were chosen as follows: for two noble cane trials, BH.10 (12), for nobilised glagah types in three trials, M. 134/32, and for a trial including seedlings derived from Uba Marot, M. 168/32.

Eighteen second year trials were reaped during the year at the Central Experiment Station, Reduit, seven in August, early in the crop season, and eleven in December at the end of the crop. From the early series, seven seedlings were selected from a total of fifty eight under trial, and these were included in a third year trial with the standard variety BH.10 (12). From the late series, twelve seedlings were selected from a total of eighty eight. These will not be planted in third year trials until 1939.

At Pamplemousses Experiment Station, eleven second year trials were reaped in September, and in these, twelve seedlings were selected from a total of eighty seven under trial. The selected seedlings were included in two third year trials with the standard variety BH.10 (12) for comparison.

Second year trials represent an important stage in the routine testing of seedlings. They are grown from cuttings, and the plots are replicated. Consequently more accurate observations can be made than in the first year trials, and the results at crop time can be subjected to statistical analysis.

In addition to their being included in third year trials, all seedlings selected from second year trials were planted in a special gumming disease resistance trial, for the purpose of assessing their degree of resistance to this disease (see section VII below).

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*Mc Intosh, A.E.S., Rept., Dept. of Science and Agriculture, Barbados, 1928-29.

V—THIRD YEAR TRIALS

These trials represent the final stage of seedling testing at the Experiment Stations, after which the most promising seedlings are allocated to variety trials on estates. At this stage, full analyses of cane samples, for all seedlings, are made at the Cane Mill Laboratory. During the year under review, one third year trial was planted at the Central Experiment Station, and five at Pamplemousses Experiment Station, while seven trials were reaped at the former station (two in virgins and five in first ratoons) and two at the latter station (both in first ratoons).

Three seedlings were selected, and planted in multiplication plots to provide planting material for variety trials. These are M.211/33 and M.213/33, both noble cane seedlings from the cross R.P.6 × M.23/16, and M.130/32, a seedling from the cross R.P 6 × POJ.2878, which represents the fourth nobilisation of glagah.

VI—VARIETY TRIALS

These trials are carried out both at the experiment stations and on estates: they are designed to test the most promising of the new seedlings against standard varieties over a range of environmental conditions representative of the several ecological areas of the island. It is on the results of these trials that the final appraisement of seedlings is made. The best performers are released by the Sugarcane Research Station, and recommended for estate planting.

Climatic Conditions.—Rainfall during the year was, on the average, considerably below the mean for the past thirty years, and yields of cane were generally lower than those obtained in the 1937 crop. Ripening conditions were excellent, however, probably largely on account of the dry conditions and low winter temperature, with the result that actual sugar production for the island reached a record total The mean extraction for the whole crop was 11.9, an unprecedented figure. It would appear that a further contributory factor to the excellence of this extraction was the low September to December rainfall, which allowed the crop to be finished before growth of the canes was renewed. Consequently extraction remained high to the end of the reaping season.

The growth index, calculated by the Statistician of the Department of Agriculture for the 1938 crop was 5.56, compared with that of 7.12 for the 1937 crop, and a mean of 6.11 for the past fourteen years.

The mean monthly rainfall figures, calculated for several stations representative of the whole island, are presented below, together with the mean for thirty years.

	1938	30-year means
January ...	4.81 inches	9.37 inches
February ...	9.96 „	9.49 „
March ...	8.94 „	11.09 „
April ...	5.97 „	7.13 „
May ...	4.99 „	6.10 „
June ...	2.48 „	4.38 „
July ...	3.44 „	3.91 „

August	...	2.06 inches	3.61 inches
September	...	1.33 „	2.39 „
October	...	2.11 „	2.41 „
November	...	1.60 „	2.79 „
December	...	2.14 „	5.72 „
Totals	...	49.83 „	68.39 „

Results of Trials.—The number of variety trials reaped at the Experiment Stations was six, of which three were in virgin canes and three in ratoons. On estates thirteen trials were reaped, three in virgin canes and ten in ratoons. Detailed results of these trials are presented in Appendix II.

The trials were mainly concerned with the performances of the four seedlings already released for general distribution, viz: M.171/30, M.72/31, M.73/31 and M.134/32, and from the results, information is available on the yielding capacity of these varieties over a wide range of conditions.

Very satisfactory results were again obtained with the varieties M.171/30, M.72/31 and M.134/32, which have consistently out-yielded the standard varieties by a significant margin, and there is little doubt that large acreages of these varieties will soon be under cultivation.

M.171/30 is a noble cane variety, of excellent growth habit and high yielding capacity, but has inherited the somewhat low juice quality of its male parent, M 27/16. Conditions during the growing season, and particularly the weather when ripening was taken place, favoured this variety at the expense of varieties of higher intrinsic juice quality, such as BH.10(12).

M.72/31 and M.134/32 are both fourth nobilisations of "glagah", and are not only vigorous types, but also have excellent juice quality.

There was not sufficient planting material for distribution to estates to supply the demands for these varieties, particularly in the case of M. 134/32. This latter variety, in spite of its tendency to arrow, and its broad leaves which suggest susceptibility to damage by high winds, is proving highly popular with the planting community, and is regarded as very promising.

During the year, six further variety trials were laid down on estates under a wide range of conditions, and including four of the varieties released by the Sugarcane Research Station. The results of these trials, together with those already obtained, should go far to indicate the most favourable regions of the island for the growth of these varieties.

M. 73/31 has proved disappointing in several trials. It has an unfavourable growth habit, and although capable of yielding well under certain conditions, is apparently susceptible to borer injury, while rotting organisms spread through the canes readily from the borer holes. This feature of rate of secondary rotting following borer attack is an important one in assessing the degree of borer resistance in new seedlings. It may be that varieties which suffer most from borer damage are not necessarily those which are the most heavily attacked by the insect in the first place. This aspect of the problem is being considered in investigations on borer resistance which are being started in co-operation with the Entomologist of the Department of Agriculture. For the present, however, and until further information is available, the writer cannot recommend the propagation of the variety M. 73/31.

M. 140/31, an unreleased variety which was included in some trials, has proved to be highly susceptible to gumming disease (*Bacterium vasculorum*). For this reason, no further trials will be made with it, nor will it be released for general planting. The danger of growing varieties susceptible to this disease cannot be too strongly emphasised, for varieties which appear tolerant to the disease may, under a particular set of environmental conditions, break down under a severe attack of the bacterium, with disastrous results commercially.

VII—GUMMING DISEASE RESISTANCE TRIALS

These trials are now carried out under the direction of the Geneticist, in co-operation with the Plant Pathologist, Department of Agriculture. Their primary object is to provide information on the degree of resistance of seedlings selected from the second year trials. From the information obtained, susceptible types are excluded from further testing, so that in future all varieties reaching the variety trial stage will be resistant to the disease. In addition, the results of the work are cumulative, and provide valuable data on the inheritance of gumming disease resistance, which is used to guide the breeding work.

In these trials all seedlings under test are planted in three-stool rows adjacent to rows of the highly susceptible variety 55/1182, which is also planted in a row on the windward side of the trial.

Inoculations are carried out with a culture of mixed strains of the causal bacterium, and periodic examinations of the plots are made. Those seedlings which show appreciable susceptibility to the disease are thereby found, and are not further tested in the routine trial scheme. It may be stated that a fair proportion of the seedlings tested show adequate commercial resistance to the disease and that these trials are a simple and reliable method of recognising these resistant types. More than three hundred and fifty seedlings have been tested since the trials were begun in 1931. In the noble cane group, approximately 69% of seedlings have proved resistant to the disease, although considerable differences are noted in the percentages of resistant types found in populations from distinct parentages. In the nobilised glagah seedlings, it is the rule to find higher percentages of resistant individuals.

VIII—PHYTALUS RESISTANCE TRIALS

These trials are carried out under the direction of the Geneticist, in co-operation with the Botanist, Sugarcane Research Station, and the Entomologist of the Department of Agriculture. Their object is to note the behaviour of certain seedlings under conditions of heavy infestation by *Phytalus Smithii*, one of the major cane pests of Mauritius. Their practical application lies in the information provided on the characters which influence degree of phytalus resistance, and the differential behaviour of seedlings from distinct parents, which will be used to guide the breeding work.

A large trial was laid down at Britannia S.E. in August, which includes thirteen varieties, involving the blood of several *Saccharum* species and from widely differing parentages. Each variety is replicated twelve times in the trial. During the growing season, periodical counts of larval population over the experimental area will be made by the Entomologist, and observations made on the behaviour of the varieties when attacked by the pest. The value of the trial clearly depends on a heavy and uniform phytalus attack, and the site was chosen, therefore, where there was reason to believe that infestation would be severe.

In addition to this large trial, five small phytalus trials have been laid down on estates where high infestations by the pest occur, and in different regions of the island. These trials include the varieties M. 167/32, M.168/32 and a standard variety, and their object is to assess the value of these promising seedlings under heavy phytalus attack.

M.168/2 has given satisfactory results in the 1938 crop, and is a vigorous, non-arrowing seedling of fair juice quality. If, as is suspected, rate of recovery from injury is an important factor in differentiating varieties with regard to their yielding capacity under phytalus attack, it may be that varieties of this type will have considerable value.

IX—DESPATCH OF FUZZ TO SOUTH AFRICA

Fuzz from three crosses was sent to Natal, at the request of the Director of the Experiment Station of the South African Sugar Association. These crosses were M.109/26 × M.108/30, M.109/26 × M.196/31 and R.P. 6 × M 84/35, and all include the blood of Uba Marot.

X—ACKNOWLEDGMENTS

The writer wishes to record his appreciation of the assistance received at various times from the divisions of the Department of Agriculture.

Réduit,
February, 1939.

G. C. STEVENSON,
Geneticist.

APPENDIX I

LIST OF CROSSES MADE AT C.E.S., & P.E.S., IN 1938

Parentage			Location of cross	No. of crosses made C.E.S.	No. of crosses made P.E.S.	No. of seedlings obtained C.E.S.	No. of seedlings obtained P.E.S.	No. of seedlings planted C.E.S.	No. of seedlings planted P.E.S.
I. Crosses between "Noble" Canes									
Ba. 11569	×	M. 171/30	C.E.S.	1	...	0	...	0	...
Black Tanna	×	D. 109	do	2	...	0	...	0	...
,,	×	M. 23/16	do	1	...	0	...	0	...
,,	×	M. 27/16	do	4	...	1	...	0	...
,,	×	M. 29/16	do	1	...	0	...	0	...
,,	×	M. 35/17	do	1	...	3	...	3	...
,,	×	M. 13/18	do	2	...	2	...	2	...
,,	×	M. 171/30	do	1	...	0	...	0	...
,,	×	SC. 12/4	do	4	...	5	...	5	...
,,	×	87. P.	do	1	...	6	...	6	...
M. 33/19	×	D. 109	P.E.S.	...	1	...	5	...	0
M. 26/20	×	M. 27/16	do	...	1	...	800	...	200
M. 171/30	×	SC. 12/4	C.E.S.	1	...	255	...	192	...
R. P. 6	×	M. 23/16	do	3	...	25	...	24	...
,,	×	M. 27/16	do	6	...	810	...	648	...
,,	×	M. 171/30	do	2	...	35	...	24	...
,,	×	SC. 12/4	do	2	...	25	...	11	...
131. P.	×	D. 109	P.E.S.	...	1	...	700	...	168
,,	×	D. 109, str. sport	do	...	1	...	245	...	120
,,	×	M. 23/16	do	...	1	...	20	...	11
,,	×	M. 24/25	do	...	1	...	350	...	137
,,	×	M. 109/26	do	...	1	...	2,500	...	117
			Total ...	32	7	1,167	4,620	915	753
II. Interspecific Crosses									
1.—2nd Nobilised Glagah :—									
Ba. 11569	×	M.Z. 22/31	C.E.S.	1	...	75	...	60	...
Black Tanna	×	,,	do	1	...	0	...	0	...
Kassoer	×	D. 109	P.E.S.	...	1	...	20	...	6
Kassoer	×	M. 23/16	do	...	1	...	0	...	0
,,	×	M. 27/16	do	...	1	...	15	...	5
			Total ...	2	3	75	35	60	11
2.—3rd Nobilised Glagah :—									
M. 26/20	×	M.X. 9/32	P.E.S.	...	1	...	0	...	0
P.O.J. 2364	×	D. 109	C.E.S., P.E.S.	1	2	59	840	52	312
,,	×	D. 109, str. sport	P.E.S.	...	2	...	450	...	312
,,	×	D. 109, white ,,	do	...	3	...	1,610	240	325
,,	×	M. 23/16	do	...	2	...	80	...	44
,,	×	M. 37/26	C.E.S., P.E.S.	1	2	320	430	210	191
,,	×	M. 109/26	C.E.S.	1	...	115	...	77	...
,,	×	87.P	do	1	...	305	...	206	...
			Total ...	4	12	799	3,410	785	1,184
3.—4th Nobilised Glagah :—									
Black Tanna	×	P.O.J. 28/78	C.E.S.	4	...	5	...	3	...
M. 20/16	×	,,	do	1	...	0	...	0	...
M. 23/16	×	,,	P.E.S.	...	1	...	0	...	0
M. 17/18	×	,,	do	...	1	...	700	...	186
M. 33/19	×	,,	C.E.S.	1	...	240	...	150	...
M. 26/20	×	,,	P.E.S.	...	3	...	660	...	330
M. 109/26	×	,,	do	...	1	...	1,000	...	0
M. 171/30	×	,,	C.E.S.	1	...	115	...	72	...
			Carried over ...	7	6	360	2,360	225	516

II. Interspecific Crosses—(*Continued*)

Parentage			Location of cross	No. of crosses made		No. of seedlings obtained		No. of seedlings planted	
				C.E.S.	P.E.S.	C.E.S.	P.E.S.	C.E.S.	P.E.S.
Brought forward ...				7	6	360	2,360	225	516
P.O.J. 2727	×	D. 109	{C.E.S., P.E.S.}	1	3	0	30	0	18
,,	×	D. 109, str. sport	P.E.S.	...	2	...	35	...	18
,,	×	D. 109, white ,,	{C.E.S., P.E.S.}	1	2	0	20	0	9
,,	×	M. 35/17	P.E.S.	...	2	...	40	...	0
,,	×	M. 37/26	do	...	3	...	30	...	0
,,	×	M.171/30	C.E.S.	1	...	15	...	0	...
P.O.J. 2878	×	D. 109	{C.E.S., P.E.S.}	5	3	77	700	35	301
,,	×	D. 109, str. sport	P.E.S.	...	5	...	640	90	308
,,	×	D. 109, white ,,	{C.E.S., P.E.S.}	4	3	40	365	30	260
,,	×	M. 23/16	P.E.S.	...	3	...	135	...	0
,,	×	M. 27/16	do	...	2	...	140	...	66
,,	×	M. 35/17	{C.E.S., P.E.S.}	2	2	75	450	0	0
,,	×	M. 13/18	C.E.S.	2	...	60	...	0	...
,,	×	M. 24/25	P.E.S.	...	2	...	825	...	0
,,	×	M. 37/26	{C.E.S., P.E.S.}	1	3	50	260	...	161
,,	×	M. 109/26	{C.E.S., P.E.S.}	2	3	35	270	0	0
,,	×	M. 171/30	C.E.S.	1	...	10	...	0	...
,,	×	Senneville	P.E.S.	...	2	...	60	...	0
,,	×	Sc. 12/4	C.E.S.	3	...	37	...	0	...
,,	×	87. P.	do	2	...	4,000	...	271	...
P.R. 6	×	P.O.J. 2878	do	1	...	10	...	0	...
55/74	×	,,	P.E.S.	...	1	...	0	...	0
131. P.	×	,,	do	...	1	...	300	...	144
			Total ...	33	48	4,769	6,660	651	1,801
4.—5th Nobilised Glagah :—									
Black Tanna	×	M. 68/31	C.E.S.	1	...	5	...	3	...
,,	×	M. 72/31	do	3	...	0	...	0	...
,,	×	M. 20/32	do	1	...	0	...	0	...
,,	×	M. 127/32	do	1	...	0	...	0	...
Fotiogo	×	M. 72/31	do	2	...	55	...	30	...
M. 20/16	×	,,	do	2	...	2,500	...	301	110
,,	×	M. 140/31	do	1	...	0	...	0	...
,,	×	M. 20/32	do	1	...	0	...	0	...
,,	×	M. 127/32	do	2	...	140	...	120	...
M. 33/19	×	POJ. 2940	P.E.S.	...	1	...	1,200	...	0
M. 26/20	×	M. 140/32	do	...	1	...	130	...	44
,,	×	POJ. 2940	do	...	1	...	120	...	44
M. 73/31	×	D. 109	C.E.S.	1	...	190	...	120	...
M. 36/32	×	D. 109	do	2	...	100	...	72	...
,,	×	M. 27/16	do	2	...	13	...	0	...
,,	×	M. 13/18	do	1	...	9	...	0	...
M. 134/32	×	BH. 10 (12)	do	2	...	0	...	0	...
,,	×	D. 109	P.E.S.	...	1	...	30	...	11
,,	×	D. 109, str. sport	do	...	2	...	190	...	54
,,	×	D. 109 white ,,	{C.E.S., P.E.S.}	2	2	0	83	...	18
,,	×	M. 23/16	P.E.S.	...	3	...	406	...	208
,,	×	M. 27/16	{C.E.S., P.E.S.}	2	1	13	425	12	128
,,	×	M. 35/17	P.E.S.	...	3	...	152	...	5
,,	×	M. 13/18	C.E.S.	2	...	115	...	96	...
,,	×	M. 24/25	P.E.S.	...	3	...	97	...	34
Carried over ...				28	18	3,140	2,833	754	656

II. Interspecific Crosses—(*Continued*)

Parentage			Location of cross	No. of crosses made		No. of seedlings obtained		No. of seedlings planted	
				C.E.S.	P.E.S	C.E.S.	P.E.S.	C.E.S.	P.E.S.
Brought forward ...				28	18	3,140	2,833	754	656
M. 134/32	×	M. 37/26	do	...	1	...	300	...	108
,,	×	M. 109/26	{C.E.S., P.E.S.}	2	1	0	200	0	97
,,	×	M. 171/30	C.E.S.	2	...	32	...	24	...
,,	×	Senneville	P.E.S.	...	1	...	80	...	0
,,	×	Sc. 12/4	C.E.S.	8	...	15	...	14	...
M. 140/32	×	D. 109	P.E.S.	...	1	...	95	...	0
POJ. 2940	×	D. 109	do	...	1	...	115	...	0
R. P. 6	×	M. 72/31	C.E.S.	1	...	660	...	468	...
,,	×	M. 140/31	do	2	...	200	...	107	...
55/74	×	M. 68/31	P.E.S.	...	1	...	1	...	0
131. P.	×	,,	C.E.S.	1	...	25	...	12	...
,,	×	M. 72/31	do	2	...	0	...	0	...
,,	×	M 127/32	do	2	...	55	...	24	...
			Total ...	48	24	4,127	3,624	1,403	861
5.—S. barberi crosses :—									
Kansar selfed seedling	×	D. 109	C.E.S.	1	...	0	...	0	...
			Total ...	1	...	0	...	0	...
6.—Chunnee crosses :—									
Black Tanna	×	Co. 213	C.E.S.	2	...	0	...	0	...
POJ. 213	×	D. 109, str. sport	P.E.S.	...	1	...	10	...	7
			Total	2	1	0	10	0	7
7.—S. sinense crosses :—									
Uba	×	M. 23/16	P.E.S.	...	1	...	0	...	0
,,	×	M. 109/26	do	...	1	...	8	...	0
,,	×	M. 108/30	do	...	1	...	42	...	35
,,	×	M 196/31	do	...	1	...	8	...	0
,,	×	POJ. 2940	do	...	1	...	0	...	0
,,	×	Selangor Seedling	do	...	1	...	45	...	35
Uba seedling No. 4	×	M. 72/31	C.E.S.	1	...	80	...	60	...
			Total ...	4	6	80	103	60	70
8.—Other crosses :—									
Black Tanna	×	M, 108/30	C.E.S.	2	...	0	...	0	...
,,	×	M. 196/31	do	1	...	0	...	0	...
,,	×	Selangor Seedling	do	5	...	1	...	1	...
,,	×	Uba Marot	do	2	...	11	...	6	...
M. 20/16	×	M. 108/30	do	2	...	250	...	160	...
,,	×	M. 196/31	do	2	...	70	...	48	...
,,	×	Selangor Seedling	do	2	...	80	...	60	...
M. 23/16	×	Uba Marot	P.E.S.	...	1	...	50	...	0
M. 33/19	×	M. 108/30	do	...	1	...	140	...	33
M. 26/20	×	,,	do	...	1	...	90	...	18
,,	×	M. 9/31	do	...	1	...	65	...	0
,,	×	Selangor Seedling	do	...	2	...	320	...	146
,,	×	Uba Marot	do	...	1	...	70	...	42
M. 109/26	×	M. 108/30	C.E.S.	2	...	0	...	0	...
,,	×	M. 196/31	{C.E.S., P.E.S.}	2	1	0	1,500	0	0
,,	×	Uba Marot	P.E.S.	...	1	...	500	...	0
M. 108/30	×	D. 109	P.E.S.	...	1	...	0	...	0
,,	×	POJ. 2940	do	...	1	...	90	...	0
,,	×	Selangor Seedling	do	...	1	...	1,500	...	0
M. 134/32	×	M. 9/31	do	...	1	...	600	...	0
,,	×	M. 72/31	C.E.S.	2	...	1,075	...	451	80
,,	×	M. 196/31	P.E.S.	...	1	...	1,000	216	306
			Carried over ...	22	14	1,487	5,925	942	625

II. Interspecific Crosses—(*Continued*)

Parentage			Location of cross	No. of crosses made C.E.S.	No. of crosses made P.E.S.	No. of seedlings obtained C.E.S.	No. of seedlings obtained P.E.S.	No. of seedlings planted C.E.S.	No. of seedlings planted P.E.S.
Brought forward			...	22	14	1,487	5,925	942	625
M. 134/32	×	POJ. 2940	do	...	2	...	2,200	143	306
,,	×	Selangor Seedling	C.E.S., P.E.S.	1	2	1	5,100	272	469
,,	×	Uba Marot	P.E.S.	...	2	...	130	...	80
M. 188/33	×	M. 108/30	do	...	1	...	245	...	0
,,	×	M. 108/32	do	...	1	...	600	192	0
Mapou Perlée	×	M. 196/31	C.E.S.	1	...	25	...	0	...
POJ. 2364	×	POJ. 2940	P.E.S.	...	3	...	390	...	0
,,	×	Selangor Seedling	do	...	2	...	575	...	0
POJ. 2727	×	M. 60/31	C.E.S.	2	...	75	...	60	...
,,	×	M. 72/31	do	1	...	35	...	24	...
,,	×	M. 108/32	do	1	...	265	...	130	...
POJ 2878	×	,,	do	2	...	4,000	...	0	...
,,	×	M.X. 9/32	P.E.S.	...	1	...	650	...	0
,,	×	POJ. 2940	do	...	2	...	1,225	...	0
,,	×	Selangor Seedling	do	...	1	...	360	...	0
,,	×	Uba Marot	C.E.S., P.E.S.	2	2	4,000	3,100	218	143
POJ 2940	×	M.X. 5/32	P.E.S	...	1	...	65	...	0
R.P. 6	×	M. 84/35	C.E.S.	2	...	0	...	0	...
,,	×	Selangor Seedling	do	1	...	30	...	0	...
Selangor Seedling	×	D. 109	do	1	...	135	...	0	...
,,	×	M. 13/18	do	1	...	230	...	0	...
,,	×	M. 37/26	do	2	...	75	...	0	...
,,	×	M. 109/26	do	1	...	25	...	0	...
,,	×	M. 108/30	do	1	...	1,500	...	201	...
,,	×	M. 171/30	do	1	...	75	...	0	...
,,	×	M. 72/31	do	1	...	2,000	...	391	93
Selangor Seedling	×	M. 196/31	C.E.S.	2	...	250	...	208	...
,,	×	Uba Marot	C.E.S., P.E.S.	1	2	130	640	88	76
,,	×	87.P	C.E.S.	1	...	700	...	210	...
Uba Marot	×	Selangor Seedling	P.E.S.	...	1	...	120	...	0
131.P	×	M. 108/30	do	...	1	...	5	...	0
,,	×	M. 196/31	C.E.S., P.E.S.	1	1	320	1,000	210	144
,,	×	Selangor Seedling	C.E.S., P.E.S.	1	...	75	...	60	...
55/74	×	M. 108/30	P.E.S.	...	1	...	110	...	72
,,	×	M. 9/31	do	...	1	...	1	...	0
			Total	49	41	15,433	22,441	3,349	2,008

III.—Intergeneric Crosses

M.Z. 6/33	×	M. 27/16	P.E.S.	...	1	...	0	...	0
			Total	...	1	...	0	...	0

IV.—Selfings

M. 23/16			P.E.S.	...	1	...	0	...	0
M. 26/20			do	...	1	...	0	...	0
M. 109/26			do	...	1	...	2,000	...	0
M. 214/32			do	...	1	...	35	...	0
M. 215/32			do	...	1	...	0	...	0
POJ. 2878			do	...	1	...	5	...	0
Selangor Seedling			do	...	1	...	55	...	0
			Total	...	7	...	2,095	...	0

APPENDIX II

RESULTS OF VARIETY TRIALS REAPED IN 1938

Trial 73—St. Antoine S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
Selangor Seedling ...	3.19	19.1	16.69	91.0	...
POJ. 2727	3.08	19.1	16.12	89.6	...
BH.10 (12)	3.03	18.0	16.83	92.4	...
M. 27/16	2.97	19.9	14.97	91.5	...
D. 109, white	2.65	17.6	15.06	87.6	...
S.C. 12/4	2.24	13.6	16.44	90.6	...
Mean ...	2.86	17.88	..	...	..
S.E.	±0.19	...	...	...	...
Significant difference ...	0.55	...	...	..	...

3rd Ratoons cut : 6.9.38 Age : 13½ months.

Layout :—Randomised block with border rows discarded. Irrigated (very seldom).

Conclusions :—There was no significant difference between Selangor Seedling, POJ. 2727, M. 27/16 and BH.10 (12), the standard. BH.10 (12) was significantly better than D. 109 white, and S. C. 12/4.

Trial 76—At André S.E.

Vartety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
POJ. 2727	5.42	34.6	15.7	84.6	...
POJ. 2828	5.17	32.3	16.0	88.2	...
Selangor Seedling ...	5.10	31.8	16.0	88.1	...
BH.10 (12)	4.57	25.1	18.2	90.9	...
R. A. 30	4.33	28.2	15.4	86.6	...
55/1182	4.08	25.7	15.9	87.0	...
D. 109	3.59	21.8	16.5	87.6	...
Mean	4.61	28.5	...	...	...
S. E.	±0.25	...	...	...	...
Significant difference ...	0.73	...	...	...	...

3rd Ratoons cut : 5.10.38. Age : 11½ months.

Layout :—Randomised block with border rows discarded. Irrigated.

Conclusions.—POJ. 2727, POJ.2878, Selangor Seedling, BH. 10 (12) and R A. 30 were all significantly better than D. 109, the standard. There was no significant difference between 55/1182 and D.109.

Trial 82—Trianon S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M 5/30	4.79	29.97	16.0	92.2	...
M.28/30	4.76	29.56	16.1	94.2	...
M.10/30	4.52	28.43	15.9	92.1	...
M.13/30	4.06	25.37	16.0	93.3	...
D.K.74	3.82	22.47	17.0	93.8	...
Mean .. .	4.39	27.16	...	...	...
S.E.	±0.13	..	...	...	...
Significant difference ...	0.39	...	...	...	...

2nd ratoons cut : 4.10.38 Age : 13 months.

Layout :—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—M.5/30, M.28/30 and M.10/30 were all significantly better than D.K. 74, the standard. There was no significant difference between M.13/30 and D.K. 74.

Trial 97—Mon Desert and Mon Trésor S.E.

Variety	Sucrose tons perarpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
POJ. 2727 ...	6.59	40.66	16.2	91.0	...
B.H. 10 (12) ...	6.33	36.79	17.2	93.5	...
POJ. 2878 ...	6.06	35.67	17.0	92.6	...
S.C. 12/4	5.13	30.73	16.7	93.6	...
Selangor Seedling ..	4.90	30.65	16.0	88.4	...
S.W. 499 ...	3.47	19.84	17.5	92.9	...
Mean	5.41	32.39	...	..	...
S.E.	±0.32	...	...	...	...
Significant difference ...	0.96	...	...	...	...

2nd ratoons cut : 28.9.38. Age : 12 months.

Layout :—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—There was no significant difference between POJ.2727 POJ.2878 and BH.10 (12), the standard. S.C.12/4, Selangor Seedling and S.W.499 were all significantly inferior to BH. 10 (12).

Trial 103—P.E.S.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o Cane	Purity	Arrows o/o Cane
M. 134/32 ...	8.50	47.2	18.0	89.9	..
M. 72/31 ...	7.85	44.6	17.6	85.9	...
M. 73/31 ...	6.66	39.9	16.7	85.9	. .
M. 171/30 ...	6.58	40.9	16.1	88.3	...
BH. 10. (12) ...	6.56	33.5	19.6	94.8	...
M. 5/30 ...	6.42	41.7	15.4	84.1	...
M. 10/30 ...	5.99	39.7	15.1	86.1	...
M. 13/30 ...	3.36	21.0	16.0	90.4	...
Mean ...	6.49	38.1	..	...	...
S. E. ...	±0.45	...	...	...	...
Significant difference ...	1.33	...	...	...	...

1st ratoons cut : 18.10.38. Age : 12½ months.

Layout.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—M.134/32 and M.72/31 were significantly better than the standard. There was no significant difference between M.73/31, M.171/30, M. 5/30, M. 10/30 and the standard, BH.10 (12), M. 13,30 was significantly worse than the standard.

Note.—This trial had suffered from a very severe attack by rats. Some plots of M. 13/30 had been practicaliy destroyed and M. 171/30. M.134/32 and BH. 10 (12) had also suffered to some extent. This accounts for the comparatively high standard error of the experiment.

Trial 104—C.E.S. (Reduit)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 134/32	6.82	42.37	16.1	93.2	10
M. 73/31	5.38	32.40	16.6	93.0	<1
M. 72/31	5.13	32.91	15.6	90.5	0
M. 5/30	4.41	30.21	14.6	90.3	0
M. 171/30	4.17	29.17	14.3	90.1	0
M. 10/30	3.86	23.85	16.2	95.9	0
M. 27/16	3.27	21.80	15.0	92.8	0
M. 13/30	2.81	17.81	15.8	91.1	0
Mean	4.48	26.31	...	...	...
S. E.	±0.52	...	...	...	...
Significant difference ...	1.52	...	...	...	...

1st Ratoons cut : 11.10.38 Age : 9.6 months.

Layout .—Randomised blocks. Not irrigated.

Conclusions :—M. 134/32, M. 73/31 and M. 72/31 were all significantly better than M. 27/16, the standard. There was no significant difference between the other varieties and the standard.

Trial 105—C.E.S. (Reduit)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 134/32	8.61	52.17	16.5	93.2	10
M. 73/31	7.67	49.26	15.6	89.2	0
M. 72/31	7.19	46.40	15.5	90.0	0
M. 5/30	5.93	42.08	14.1	90.2	0
M. 171/30	5.84	41.84	14.2	89.3	0
M. 10/30	5.58	35.78	15.6	92.8	0
M. 27/16	4.52	31.87	14.2	92.8	<1
M. 13/30	4.50	30.04	15.0	92.8	0
Mean	6.23	41.18	...	...	...
S. E. ...	±0.44	...	...	...	...
Significant difference	... 1.29	...	...	..	...

1st Ratoons cut : 10.10.38. Age : 11½ months.

Layout : Randomised blocks. Irrigated.

Conclusions :—M. 134/32, M. 73/31, M. 72/31, M. 5/30 and M 171/30 were significantly better than M. 27/16, the standard. There was no significant difference between M. 10/30, M. 13/30 and the standard.

Trial 106—Rivière des Anguilles S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows % cane
M. 171/30 ...	8.41	59.68	14.1	89.6	...
M. 72/31 ...	8.03	50.21	16.0	93.2	...
M. 3/31 ...	7.38	53.87	13.7	87.6	...
BH.10 (12) ...	6.80	42.60	16.0	92.3	..
R.A. 4/24 ...	6.18	45.75	13.5	89.9	...
Mean ..	7.36	50.40	...	...	...
S.E. ...	±0.25	...	...	...	...
Significant difference ...	0.76	...	...	...	...

1st ratoons cut : 14.10.38. Age : 12 months

Layout.—Randomised blocks. Not irrigated.

Conclusions.—M. 171/30 and M. 72/31 were both significantly better than BH.10 (12), the standard. There was no significant difference between M. 73/31, R.A. 4/24 and the standard.

Trial 107—Britannia S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 73/31 ...	3.17	23.51	13.5	87.0	...
M. 171/30 ...	3.02	24.55	12.3	88.6	...
R.A. 4/24 ...	2.97	23.96	12.4	88.3	...
S.C. 12/4 ...	2.04	15 44	13.2	88.9	...
White Tanna ...	1.68	12.92	13.9	89.7	..
Mean ...	2.58	20.07	...	...	...
S.E. ...	±0.13	...	...	...	..
Significant difference	0.40	...	...	...	..

1st ratoons cut: 23.2.38. Age: 8½ months.

Layout.—Randomised blocks. Not irrigated.

Conclusions.—M. 73/31, M.171/30 and R.A. 4/24 were significantly better than White Tanna, the standard. There was no significant difference between S.C. 12/4 and White Tanna.

Trial 108—Rich Fund S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 73/31	6.41	43.6	14.7	90.1	...
M. 171/30	6.20	42.5	14.6	90.7	...
BH. 10(12)... ...	5.29	33.7	15.7	92.5	...
Mean	5.97	39.9	...	...	...
S. E.	±0.21	...	...	...	...
Significant difference ...	0.66	...	...	...	...

1st ratoons cut: 19.9.38. Age: 11¾ months.

Layout:—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—Both M. 73/31 and M. 171/30 were significantly better than BH. 10(12), the standard.

Trial 109—Beau Bassin

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 171/30... ...	5.57	36.41	15.3	90.6	...
D.K. 74	4.13	29.49	14.0	92.7	...
BH. 10(12) ...	4.04	24.77	16.3	94.8	...
131. P	2.14	14.09	15.2	92.7	...
Mean ...	3.97	26.19	...	...	...
S.E.	±0.34	...	...	...	...
Significant difference ...	1.04	...	...	...	...

1st Ratoons cut: 6.10.38. Age: 11 months.

Layout:—Randomised blocks. Irrigated.

Conclusions.—M. 171/30 was significantly better than D.K. 74, the standard. There was no significant difference between BH. 10(12) and D.K. 74, but 131 P was significantly inferior to the standard.

Trial 110—Beau Bassin

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 73/31	6.64	41.26	16.1	93.6	...
M. 72/31	5.14	30.94	16.6	92.7	...
D.K. 74	2.78	22.24	14.5	92.7	...
Mean	4.85	31.48	...	...	...
S.E.	±0.62	...	...	...	...
Significant difference ...	2.15	...	...	...	...

1st Ratoons cut : 6.10.38. Age : 11 months.

Layout : Randomised blocks. Irrigated

Conclusions :—Both M. 73/31 and M. 72/31 were significantly better than D. K. 74, the standard.

Trial 116—Mon Désert (St. Pierre)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows o/o cane
M. 73/31	6.46	43.92	14.7	92.4	...
M. 72/31	6.42	37.76	17.0	94.0	...
M. 171/30	5.79	38.34	15.1	90.7	...
BH. 10 (12)	4.31	25.06	17.2	93.8	...
White Tanna	3.87	25.14	15.4	89.9	...
Mean	5.37	34.04	...	...	...
S. E.	±0.21	...	...	...	...
Significant difference ...	0.65	...	...	...	...

1st Ratoons cut : 22-23.11.38. Age : 11 months.

Layout.—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—M. 73/31, M. 72/31 and M. 171/30 were significantly better than White Tanna, the standard. There was no significant difference between BH. 10 (12) and White Tanna.

Trial 117—Réunion S. E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 72/31	6.0	43.19	13.9	90.0	...
M. 73/31	5.61	38.94	14.4	89.6	...
BH. 10 (12)	4.29	28.23	15.2	94.0	...
Mean	5.50	36.79	...	...	...
S. E.	±0.52	...	...	...	...
Significant difference ...	1.63	...	...	...	...

Virgins planted : 23.12.36 Cut : 21.9.38 Age : 21 months.

Layout.—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—M. 72/31 was significantly better than BH. 10 (12), the standard. There was no significant difference between M. 72/31 and M. 73/31 and between M. 73/31 and the standard.

TRIAL 118—SANS SOUCI S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 171/30 ...	7.70	60.6	12.7	86 9	...
M. 72/31 ...	5·78	50.7	11.4	83.7	...
M. 73/31 ...	5.35	47.8	11.2	80.9	...
BH. 10 (12) ...	5.31	40.2	13.8	90.1	...
White Tanna ...	4.88	39.1	12.5	88.7	...
R.A. 4/24	3.54	30.8	11.5	86.1	...
Mean ...	5.43	44.9	...	...	...
S.E. ...	±0.41	...	...	...	...
Significant difference ..	1.20	...	...	...	...

Virgins planted: 27.1.37. Cut: 23–24.8.38. Age: 20 months.

Layout.—Randomised blocks. Not irrigated.

Conclusions.—M. 171/30 was significantly better than White Tanna, the standard. There was no significant difference between M. 72/31, M. 73/31, BH. 10 (12) and White Tanna. R.A. 4/24 was significantly inferior to the standard.

TRIAL 121—ST. ANDRÉ S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 140/31 ...	7.16	44.46	16.11	90.3	...
M. 72/31 ...	6.32	40.77	15.49	92.0	...
M. 171/30 ...	6.13	43.20	14.18	90.0	...
POJ. 2878 ...	6.04	36.54	16.53	89.4	...
M. 134/32 ...	5.94	38.43	15.46	89.3	...
M. 73/31 ...	4.80	36.54	13.14	86.6	...
S.A. 3 ...	4.79	39.96	11.99	85.2	...
M. 13/30 ...	4.26	30.33	14.04	89.6	...
Mean ...	5.68	38.78	...	...	...
S.E. ...	±0.35	..	...	...	...
Significant difference	1.00	...	...	...	...

Virgins. Cut: 17.9.38. Age: 12½ months.

Layout.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—M. 140/31 was significantly better than all the other varieties except M. 72/31. There was no significant difference between M. 72/31, M. 171/30, POJ. 2878 (the standard) and M. 134/32. M. 13/30, M. 73/31 and S.A. 3 were significantly worse than the standard.

Notes.—The variety M. 140/31, although giving a good performance in this trial, is highly susceptible to gumming disease. It cannot be recommended for this reason, nor will it be released for general distribution.

S.A. 3 yielded fairly well in the field, but, as will be seen from the above table, its juice quality proved to be quite inferior. This variety is quite unsuited to Mauritius conditions, and should not be propagated.

TRIAL 122—C.E.S. (RÉDUIT)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 158/32 ...	7.04	46.45	15.1	89.2	...
M. 155/32 ...	6.45	47.79	13.5	87.6	...
BH. 10(12)	5.92	34.40	17.2	93.1	...
M. 200/32 ...	5.87	38.89	15.1	90.0	...
M. 201/32 ...	5.47	42.11	13.0	88.0	...
M. 160/32 ...	5.05	40.38	12.5	83.0	...
Mean ...	5.97	41.67	...	...	...
S.E. ...	±0.35	...	...	...	...
Significant difference ...	1.05	...	...	...	...

Virgins planted : 23.9.37. Cut 25.10.38. Age : 13 months.

Layout.—Randomised blocks. Irrigated.

Conclusions.—M.158/32 was significantly better than BH. 10(12), the standard. There was no significant difference between the other varieties and and the standard.

Notes.—None of these seedlings was selected for further trial. M.158/32 is susceptible to gumming disease, and the others are inferior seedlings.

TRIAL 123—C.E.S. (RÉDUIT)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 167/32...	7.86	68.35	11.5	75.2	...
M. 168/32...	7.63	54.88	13.9	83.9	...
M. 179/32...	6.60	58.96	11.2	77.3	...
M. 176/32...	6.36	63.02	10.1	69.2	...
POJ. 2878 ..	3.74	23.35	16.0	92.1	...
Mean ...	6.44	53.71	...	...	...
S. E. ..	±0.36	...	...	...	...
Significant difference ...	1.10	...	...	...	...

Virgins planted : 23.9.37. Cut : 3.11.38. Age : 13½ months

Layout :—Randomised blocks. Irrigated.

Conclusions.—All the varieties were significantly better than POJ. 2878, the standard.

NOTE.—POJ. 2878 was sevely damaged by deer early in the growing season, and gave a yield much lower than normal.

Trial 124—P.E.S.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose o/o cane	Purity	Arrows o/o cane
M. 170/33 ...	5.96	44.8	13.3	83.7	...
BH.10 (12)	5.23	32.5	16.1	90.7	...
M. 132/33	5.18	40.5	12.8	81.8	...
M. 168/33 ...	5.04	33.2	15.2	88.3	...
M. 184/33	4.26	32.3	13.2	80.4	...
M. 193/33	4.17	32.6	12.8	80.0	...
Mean	4.97	36.0	..	...	...
S. E.	±0.18	...	...	...	...
Significant difference ...	0.51	...	...	. .	...

Virgins cut 8.11.38 Age ; 12 months.

Layout.—Randomised blocks. Irrigated.

Conclusions.—M. 170/33 was significantly better than the standard. There was no significant difference between M. 132/33, M. 168/33 and the standard. M. 184/33 and M. 193/33 were significantly worse than the standard.

Note.—The juice quality of M. 170/33 was so poor that this seedling was eliminated. M. 168/33 was selected for further trial.

PART II—CHEMISTRY

By N. Craig.

The Senior Chemist acted as Geneticist from the beginning of the year under review until the arrival of the Geneticist on July 27th, and consequently for more than half of the year this division was under staffed. Even on the return of this officer to his substantive post, much of his time was taken by administrative duties, and by work in connection with the Committee dealing with the Small Planters' canes, etc. Consequently the amount of purely chemical work carried out in this division had to be limited in amount. A certain amount of routine analysis of soils in connection with manurial trials were performed. In addition to this, laboratory work included some work dealing with the fixation and retention of potash in soils, and also a considerable amount of work dealing with the use of leaf analyses as an aid to diagnosing plant food deficiencies in the soil. A number of manurial trials were reaped, and a large number of new trials have been laid down by the aid of the two extra field assistants.

POTASH

In previous work, it has been shown that there is a progressive decrease in soil potash on passing from districts of low rainfall to those of high. This indicates that there is definitely a possibility of potash being removed from the soil in drainage, although it affords no knowledge of the rate at which this loss occurs. The fact remains, however, that potash is much more urgently needed in those districts where the rainfall is high, and it is precisely in these districts that the danger of loss in drainage water becomes greatest. Again, the unit price of potash is fairly high and consequently the fate of potash which may be applied in the fertiliser mixture is of great importance. A certain amount of work has been done therefore to elucidate this point, and to show whether it can be fixed in a non-exchangeable form, whether it can readily be lost in the drainage water or whether it is retained in a readily available or exchangeable form.

FIXATION OF K_2O IN A NON-EXCHANGEABLE FORM

The method employed for testing the capacity of Mauritius soils for fixing added potash in a non-exchangeable form was that described by Volk (Soil Sc., Vol. XXXVII,) p. 273. In this method, a known quantity of soil is treated with a definite volume of standard KCl solution, and a similar quantity treated with an equal volume of distilled water. The two samples are then alternately dried at 70°C and wetted with distilled water, ten times in all, the whole procedure lasting four to five days. The two differently treated samples were then extracted three times with 200 ccs of neutral ammonium acetate solution, according to the method of Volk-Truog. A fourth extraction failed to dissolve any further potash. The extracts were analysed by the Volk-Truog method, with the results given below.

The soils employed in this work were typical samples of surface soils of the major soil types in the island. They have all been described elsewhere, but very short descriptions are given. The Belle Rive soil is a highly laterised, mature soil, and consequently it has a low base exchange capacity, the sum of exchangeable bases is low, and consequently the pH value low (5.25). It is very low in exchangeable potash. The Béga soil is a mature soil with an intermediate degree of laterisation, a medium base exchange capacity, the

base saturation fairly high, so that the pH value is 6.5. Its exchangeable K_2O content is medium. The La Ferme soil is a mature soil, with a low degree of laterisation, a comparatively high base exchange capacity, the base saturation being high, and consequently the pH value is 7.5. Its content of exchangeable K_2O is high.

The Plaine Lauzun soil has not been formed by a lateritic alteration, but by a clay alteration. It is grey in colour, and has a high base exchange capacity, with a medium degree of saturation, so that the pH value is 6.3. Its content of exchangeable K_2O is medium to high.

The fixation tests were carried out three times at intervals of a few months, and the following results were obtained :—

Mgrs of Exchangeable K_2O % Air-Dry Soil

Soil No.	Location	Initial content of exchangeable K_2O			Content of exchangeable K_2O after addition of 50 mgrs. K_2O per 100 grms. soil			Mean fixation in non-exchangeable form % added
		1	2	3	1	2	3	K_2O
P_3A	Belle Rive ...	7	9	8	56	60	56	2%
P_2A	Béga ...	22	22	21	69	67	69	6%
P_4A	La Ferme ...	39	41	41	90	93	92	0%
P_5A	Plaine Lauzun ...	26	27	27	55	63	...	36%

From the figures given in this table, it is evident that in all the soils formed by a lateritic alteration the fixation of added potash in the non-exchangeable form is so small as to be negligible ; indeed, it is quite possible that the small fixation found falls within the limit of experimental error. A different state of affairs is seen, however, in the case of the grey soil from Plaine Lauzun, wherein roughly two-thirds of the added K_2O was recovered in the exchangeable form, so that it must be concluded that the remainder has been fixed in a non-exchangeable form.

From this and previous work, it is seen that the mature soils of a lateritic nature have a considerable power of fixing phosphates in a form not readily soluble in dilute acid, but no power to fix potash in a non-exchangeable form. Conversely, the grey soil of Plaine Lauzun which is economically unimportant, has a reduced power of fixing phosphates in a form not readily available for plant growth, but a considerable power to fix K_2O in a non-exchangeable form.

Another important point to be investigated is the power which the soil possesses of retaining added potash and so preventing loss in drainage water. A common feature of the climate of Mauritius is the liability to very heavy rainfalls in short intervals of time, up to 10 inches of rain or more per day. It is obvious that with such precipitation there must be excessive drainage, and in some cases considerable surface wash. In the latter case, a certain amount of soil, together with any fertilisers therein, is lost. One soil only has been tested so far to see to what degree added potash is removed in the drainage water.

A metal cylinder, 33 sq. cms. cross section and 30 cms long was filled with soil and saturated with water. Potassium chloride was then added to the surface in solution, at the rate of 40 kgs K_2O per acre. Water was then added in successive amounts of 1 inch, and the drainage following each successive application was collected separately, and analysed. The only soil so far tested was from Réduit, *i.e.* a mature soil with an intermediate degree

of laterisation, and consequently the actual analytical results are not given, but only a summary. Chlorine began to appear in the drainage after the addition of 4 inches of water, and by the time that 10 inches had been applied, all the chlorine applied in the K_2Cl had been recovered in the drainage. A sensitive sodium cobaltinitrite test failed to show any K_2O in the drainage and therefore it may be assumed that it was all retained in the exchangeable form. Should this result be supported by others to be done in future, it would appear that even very heavy rainfalls will fail to remove potash applied in fertiliser from the zone of action of the roots of the sugarcane.

Foliar Diagnosis

In the previous Annual Report, *i.e.* for 1937, a certain amount of preliminary work was reported on the possibility of diagnosing plant food deficiencies in the soil, by the aid of analysis of leaves from plants growing therein. This work has been continued on an increased scale during 1938, with the results given later. It has been decided that future work will be done in collaboration with the Botanist.

The chief points which have been investigated are :—

(*a*) The distribution of moisture and chief plant food constituents between lamina and mid-rib.

(*b*) The distribution of plant food material between leaves of different rank.

(*c*) The effect of age of plant and season upon the plant food content of the leaves.

(*d*) The effect of variety.

(*e*) The effect of omitting any one element from the fertiliser mixture upon the composition of the leaf.

(*a*)—The distribution of moisture and chief plant food constituents between lamina and mid-rib

One sample of leaves was taken from each of five different varieties. The sample was divided into two portions, one consisting of the laminae of the leaf blades, and the other of the mid-ribs, each of these portions being analysed separately by the usual methods. These samples were derived from Trial 105, a variety experiment situated at the Central Experiment Station, grown under irrigated conditions.

The results obtained are given in the following table :—

DISTRIBUTION OF MOISTURE AND PLANT FOOD BETWEEN LAMINA AND MID-RIB.

Variety	Moisture % green weight			Nitrogen % dry weight			Phosphoric acid as P_2O_5 % dry weight			Potash as K_2O % dry weight		
	Total leaf	Lamina	Mid-rib	Total leaf	Lamina	Mid-rib	Total leaf	Lamina	Mid-rib	Total leaf	Lamina	Mid-rib
M. 27/16 ...	75.1	71.6	79.0	1.23	1.70	0.52	0.21	0.26	0.12	1.48	1.10	2.04
M. 171/30 ...	73.3	68.6	78.7	1.19	1.57	0.50	0.25	0.32	0.12	1.37	1.03	1.98
M. 72/31 ...	71.9	68.6	76.3	1.27	1.67	0.55	0.25	0.32	0.10	1.27	0.95	1.84
M .73/31 ...	75.7	69.2	81.1	1.17	1.68	0.48	0.29	0.38	0.17	1.30	0.83	1.69
M. 134/32 ...	73.2	68.7	79.1	1.37	1.75	0.59	0.34	0.41	0.18	1.56	1.08	2.54
Average for all varieties ...	73.8	69.3	78.8	1.25	1.67	0.53	0.27	0.34	0.14	1.38	1.00	2.02

The figures given in this table show that the moisture, nitrogen, phosphoric acid and potash are very unequally distributed throughout the leaf. The mid-rib contains considerably more moisture than does the lamina. At the same time the dry matter of the lamina contains much more nitrogen and phosphoric acid than does that of the mid-rib, whereas the opposite is the case with respect to the potash. Consequently, it is of the utmost importance that the proportion of lamina to mid-rib in the sub-sample taken for analysis should be truly representative, otherwise abnormal results will be obtained.

(*b*)—The distribution of plant food material between leaves of different rank

In all the leaf analyses so far performed, the sample was taken in the following way : the leaves still rolled up and not fully expanded are counted as the first leaf, the first fully expanded leaf as number two and the second fully expanded leaf, which is ranked as number three is taken for the sample. In order to get some idea of the variation in the distribution of N, P_2O_5 and K_2O in the leaves of different rank, four samples were taken from a plot of M. 168/32. These four samples consisted of leaves of different rank, from the 2nd to 5th. The analytical results obtained are given in the table below:—

Composition of leaves of different rank

F.11. C.E.S., M. 168/32

Rank of leaf from top	Green weight (in grs)	% dry matter of leaf			Sum	% sum N+P_2O_5+K_2O		
		N	P_2O_5	K_2O	N+P_2O_5+K_2O	N	P_2O_5	K_2O
2 ...	26.1	1.46	0.31	1.39	3.16	46.2	9.9	43.9
3 (normal)	25.4	1.48	0.29	1.28	3.05	48.5	9.5	42.0
4 ...	23.4	1.48	0.28	1.05	2.81	52.7	10.0	37.3
5 ...	22.4	1.46	0.28	0.93	2.67	54.7	10.3	35.0

Judging from these figures, it is evident that care should be taken during the sampling of the leaves in the field to see that leaves of the same rank should be selected. The green weight per leaf shows a continuous drop from the youngest fully expanded one to the oldest. Again, the sum of the N, P_2O_5 and K_2O also shows a steady fall, due chiefly to the smaller amount of potash in the older leaves. Indeed, there is not much variation in so far as the nitrogen and phosphate contents are concerned, which would indicate that there is not much transference of these elements from the older leaves to the younger. There is, however, a very pronounced drop in the potash content, from 1.39% in the second leaf to 0.93% in the fifth leaf, indicating that there may be a considerable transference of potash from older to younger leaves. As a result of this, the proportions of nitrogen and phosphoric acid in the sum of the plant foods show a steady increase whereas there is a pronounced drop in the proportion of potash, so that should a mixing of leaves of different rank take place, the results would be of little or no value in helping to diagnose the lack of these elements in the soil.

(*c*) The Effect of Age and Season on the Composition of the Leaf

Many series of analyses have been carried out to test this effect, but it is proposed to give only three sets of figures as an illustration of the differences which were found at different periods of the year, two from manurial trials and the third from a variety trial. In the variety trial, the leaves of five varieties were analysed, and the figures given are the means for all five varieties at the different times.

TRIAL 103—PAMPLEMOUSSES EXPERIMENT STATION (1ST RATOONS)

Date	% in the dry matter N	P_2O_5	K_2O	Sum of $N+P_2O_5+K_2O$	Amount of each nutrient % total N	P_2O_5	K_2O
8.2.1938	1.02	0.37	1.74	3.13	32.7	11.7	55.6
14.4.1938	1.33	0.13	2.21	3.98	33.7	10.8	55.5
14.7.1938	1.27	0.35	2.02	3.65	34.9	9.7	55.4

TRIAL BIO. 5—CENTRAL EXPERIMENT STATION

BH. 10 (12)—1ST RATOONS—N.P.K. PLOTS

Date	% in dry matter N	P_2O_5	K_2O	Sum of $N+P_2O_5+K_2O$	Amount of each nutrient % total N	P_2O_5	K_2O
12.12.37	1.72	0.34	1.25	3.35	52.0	10.3	37.7
9. 2.38	1.10	0.30	1.50	2.90	37.9	10.4	51.8
11. 4.38	1.57	0.36	1.73	3.66	42.9	9.8	47.3
2. 7.38	1.34	0.27	1.38	2.99	44.8	9.0	46.2

TRIAL BIO. 9—CASCADE, ROSE BELLE S.E.

BH.10 (12)—VIRGIN CROP—N.P.K. PLOTS

Date	% in dry matter N	P_2O_5	K_2O	Sum of $N+P_2O_5+K_2O$	Amount of each nutrient % total N	P_2O_5	K_2O
Dec. 1937 ...	1.41	0.36	0.76	2.53	55.7	14.2	30.1
12.2.38 ...	1.39	0.39	1.25	3.03	45.9	12.9	41.2
25.4.38 ...	1.48	0.41	1.48	3.37	43.9	12.2	43.9

With the results available, it is impossible to separate the effect of age from that of season of the year, but two experiments which include different planting times have been started, and these may help in isolating the two effects. It must be noted that the usual fertiliser treatments were afforded these sugar canes, and consequently these applications may have affected the composition of the leaf.

From the results quoted, however, it is obvious that there is a distince variation between the different samplings, both with respect to the absolute quantities of the seve al plant nutrient contents of the leaves, and also in tht relative quantity of each, and the variations are not constant in each case. The one constant feature in the three trials quoted is a progressive drop in the ratio of the P_2O_5 content with advancing season. In both cases where lack of potash was acting as limiting factor, both the absolute amount of potash and the relative quantity in the leaf shows a distinct tendency to rise with increased age, and this is possibly due to the ease with which potash can be transferred from the older leaves to the younger ones, and the increase in potash is accompanied by a decrease in nitrogen. In every case the maximum total plant nutrient content was found in the leaves in April, *i.e.* just about the time that growth is beginning to slow down. In the two cases where samples were taken in July, a lowered content was noted.

It is obvious, therefore, that some consideration must be given to the time of sampling if the method is to be of value as an aid in diagnosing work. On the other hand, however, for the method to be of full value, the information is necessary fairly early in the growth cycle, as it is obvious that information regarding plant food deficiencies near the end of the growing season are practically valueless.

(*d*) The Effect of Variety upon the Composition of the Leaf

In some previous work, on the possibility of using juice analysis in diagnosing deficiencies of plant food in the soil, it was shown that the influence of variety was extremely great. Thus, in one variety trial containing 36 plots each of White Tanna and R.P. 6 and 18 plots of R.P. 73, the mean concentration of P_2O_5 in the juice of these varieties was 25, 14 and 6 mgrs. of P_2O_5 per 100 ccs. juice, respectively. It is obvious that if variations of this order occurred in the leaves of different varieties interpretation of results would be rendered more difficult. In order to test this point, four trials in which there were replicated plots of two or more different varieties were growing were sampled, one composite sample being taken for each variety in the trial from all the plots. Three of these trials were variety trials, the results of which are published in the Geneticist's section, whilst the fourth was a manurial trial at Cascade, Rose Belle S.E., which contained two varieties only. In two of these trials, periodic analyses were carried out, but in order not to complicate the question by the effect of season, only those analyses performed at about the same time are given in this connection.

Trial 105—P.E.S.—1st Ratoons

Variety	Amount of each nutrient % dry matter			Total $N+P_2O_5+K_2O$	Amount of each nutrient % total		
	N	P_2O_5	K_2O		N	P_2O_5	K_2O
M. 171/30 ...	1.20	0.37	2.06	3.63	33.1	10.2	56.7
M. 72/31 ...	1.34	0.43	2.46	4.23	31.7	10.2	58.1
M. 73/31 ...	1.34	0.42	1.88	3.64	36.8	11.6	51.6
M. 134/32 ...	1.43	0.52	2.29	4.24	33.7	12.3	54.0
BH. 10 (12) ...	1.37	0.41	2.36	4.14	33.1	9.9	57.0

Trial 104—C.E.S.—1st Ratoons (high experimental error)

Variety	Amount of each nutrient % dry matter			Total $N+P_2O_5+K_2O$	Amount of each nutrient % total		
	N	P_2O_5	K_2O		N	P_2O_5	K_2O
M. 171/30 ...	1.46	0.29	0.66	2.41	60.6	12.0	27.4
M. 72/31 ...	1.57	0.33	0.93	2.83	55.5	11.7	32.8
M. 73/31 ...	1.46	0.31	0.96	2.73	53.5	11.4	35.1
M. 134/32 ...	1.68	0.34	1.36	3.38	49.7	10.0	40.3
M. 27/16 ...	1.48	0.30	1.08	2.86	51.7	10.6	37.7

Trial 118—Sans Souci S.E.—Virgin canes

Variety	Amount of each nutrient % dry matter			Total $N+P_2O_5+K_2O$	Amonnt of each nutrient % total		
	N	P_2O_5	K_2O		N	P_2O_5	K_2O
M. 171/30 ...	1.15	0.34	1.39	2.88	39.9	11.8	48.3
M. 72/31 ...	1.32	0.39	1.56	3.27	40.4	11.9	47.7
M. 73/31 ...	1.35	0.43	1.13	2.91	46.4	14.4	38.8
White Tanna ...	1.26	0.38	1.61	3.25	38.8	11.7	49.5
BH. 10(12) ...	1.34	0.42	1.78	3.49	38.4	12.0	49.6

TRIAL BIO. 9—CASCADE, ROSE BELLE S.E.—VIRGIN CANES
(FROM N.P.K. PLOTS)

Variety	Amount of each nutrient % dry matter			Total $N+P_2O_5+K_2O$	Amount of each nutrient % total		
	N	P_2O_5	K_2O		N	P_2O_5	K_2O
White Tanna ...	1.29	0.36	1.58	3.23	40.0	11.1	48.9
BH 10 (12) ...	1.48	0.41	1.48	3.37	43.9	12.2	43.9

The figures given in these tables show that variety has a fairly big effect upon the absolute amount of N, P_2O_5 or K_2O contained in the dry matter of the leaf, and also upon the total $N+P_2O_5+K_2O$. The order for the different varieties with respect to the total alimentation remains the same, however, in different localities. Thus in all three trials in which it takes part, M. 171/30 contains the smallest quantity of plant nutrients, and it it closely followed by M. 73/31. The other varieties M.72/31, M.134/32 and B.H.10 (12) contain a higher amount, and are of approximately the same order, and White Tanna from the results of two trials with B.H.10 (12) seems to contain a similar amount. Moreover, a similar state of affairs can be noted with respect to the individual plant foods, M.171/30 containing the least and M.134/32 the most. The significance of this cannot at present be explained, whether for instance M.134/32 has a much bigger power of absorbing plant nutrients from the soil than has M.171/30, so that the growth of the latter is limited by the reduced uptake, or whether M.171/30 has the power of making its maximum growth with this reduced intake cannot be ascertained.

In the case of Trial 104, it must be remarked that a very high experimental error was found when the field was reaped, showing that in all probability the soil was very uneven. Except in the case of this one trial the figure showing the proportion of N, P_2O_5 and K_2O in the total plant food nutrients contained in the leaf shows much greater uniformity than do the absolute figures, and in general the figures for all varieties in a single locality give similar indications with respect to the available nutrients in the soil. Thus, for instance, in Trial 103, at Pamplemousses Experiment Station, all varieties tend to show a lack of nitrogen and an excess of potash. On the basis of these results, potash has been reduced in the fertiliser programme and nitrogen somewhat increased. In Trial 104, the general tendency seems to be that nitrogen is somewhat high, and potash low, but the variation, as explained above is fairly high. The results at Sans Souci S.E. are surprising in that this trial is situated in an area which is naturally low in readily available phosphate and potash. All varieties show, however, that the leaves are abundantly supplied with phosphate and potash, and deficient in nitrogen. This trial was planted in 1936, and the samples were taken in the latter part of March 1938, when the canes had nearly completed their growth cycle. Consequently it may be inferred that the method of fertilising in that experiment provides a sufficiency of available phosphate and potash in the scums, molasses and in the phosphatic and potash fertilisers applied to the virgin crop.

The figures for the Cascade, Rose Belle S.E. experiment are very similar to those for Sans Souci; this trial also is situated in a naturally impoverished soil, and had been planted in 1936, and sampled in April 1938, near the end of the growth cycle of the canes.

On the whole, these figures indicate that the absolute figures for the individual plant nutrients in any one variety may not be of much value in helping to detect a deficiency of these elements in the soil. A consideration of the relative proportions in the total plant nutrients in the leaf may, however, be of considerable help in recognising whether the supply of plant food in the soil is properly balanced or not. It may be also that with a knowledge of the variety and of the sum of nutrients in the leaf some estimate of the general level of fertility can be made.

(*e*) The Effect of omitting one Plant Nutrient from the Fertilisers upon the composition of the Leaf.

Samples of leaves from several trials were analysed with the object of determining this effect, and in two periodic analyses were made. The average figures from the several analyses made at different times are given for the leaves derived from the different plots.

Trial Bio. 9—Cascade, Rose Belle S.E.—Virgin Canes.

Plot Treatment	White Tanna				B.H. 10 (12)			
	Sum of $N+P_2O_5+K_2O$	Amount of each nutrient expressed % of the sum			Sum of $N+P_2O_5+K_2O$	Amount of each nutrient expressed % of the sum		
		N	P_2O_5	K_2O		N	P_2O_5	K_2O
N.P.K. ...	2.94	44.4	12.3	43.3	2.98	48.5	13.1	38.4
N.P. (no K)	2.51	59.4	16.4	24.2	2.54	63.2	15.8	21.0
N.K. (no P)	2.90	44.7	10.8	43.4	2.96	49.0	11.5	39.5

Trial Bio. 5—Central Experiment Station, Reduit
BH. 10 (12)—1st Ratoons

Plot Treatment	Sum of $N+P_2O_5+K_2O$	Amount of each nutrient % of the sum		
		N	P_2O_5	K_2O
N.P.K. ...	3.22	44.4	9.9	45.8
N.P. (no K) ...	2.74	51.9	10.9	37.3
N.K. (no P) ...	3.18	44.6	8.1	47.3

When these two trials were harvested, the yield of cane in trial Bio. 9 showed that there was very little response to the phosphatic fertiliser, but that the response to the potash was extraordinarily high, being about 21 tons per arpent. In trial Bio. 5, significant responses were obtained to both phosphate and potash, the actual increases being 8.5 tons and 7.8 tons respectively.

In Trial Bio. 9, it will be seen that the figures obtained with both varieties are very similar. The elimination of the potash from the fertiliser programme has resulted in much less potash being found in the leaf, a drop of about 50% having occurred in the absolute amounts found, and there seems little room for doubt that the big drop in yield is closely connected with the scarcity of potash in the soil. The increased proportion of nitrogen and phophoric acid is due chiefly to the smaller quantity of potash although a slight increase in the absolute quantities is noticeable. Similarly where phosphates have been omitted, there is a demonstrable drop in the amount of P_2O_5 in the leaf. Even with reduced amount, however, it appears that lack

of P_2O_5 has not been acting as a limiting factor, in view of the small difference in yield, but it should be noted that the amounts discovered are still fairly satisfactory, the proportions being still greater than in the N. P. K. plot of trial Bio. 5 In this trial, fairly big drops in the amounts of K_2O and P_2O_5 have occurred in the leaves of the plots wherein these plant foods have not been applied and in both cases significant reductions in yield have occurred.

In the other trials sampled, there were only minor differences in yield, and the variations in the composition of the leaf were also small. Thus, in a form of phosphate trial, all plots gave the same yield and there was practically no difference in the amount of P_2O_5 in the leaves. In Trial 70, at Bel Air-St. Felix small, but not significant, differences in yield were noted, and the differences in the composition were small, although slight reductions occurred when one plant food was omitted.

These results show, therefore, that there are definite possibilities in the method.

In general, the results of the analyses so far completed are of an encouraging nature; the method has been shown to be fairly sensitive, particularly with respect to potash, although reduced amounts of P_2O_5 (and also of N in one experiment, the results of which are not published) were also noticed when these elements were omitted from the fertiliser programme. The ratios between the different substances were not affected to such an extent by varietal differences as to invalidate the information gained, and it is considered that this method may be a valuable auxiliary method in helping to improve the fertiliser programme.

JUICE ANALYSIS OF SUGAR CANE

Another physiological method which has been investigated as a possible aid in diagnosing plant food deficiencies in the soil is that of juice analysis. Several analyses of juice have been performed on canes derived from plots wherein leaf analyses were done. The results from three of these trials are given in the table below, together with corresponding results obtained from the leaves.

Trial	Plot	Variety	mgrs. % cc. juice		% dry matter of leaf	
			P_2O_5	K_2O	P_2O_5	K_2O
T. 69	Low fertilisers	M. 27/16	10	38	0.30	0.78
T. 69	High „	M. 27/16	9	61	0.29	1.24
Bio. 5	Complete fertiliser	BH.10 (12)	6	42	0.32	1.47
Bio. 5	No potash	BH.10 (12)	6	25	0.30	1.02
Bio. 5	No phosphate	BH.10 (12)	4	40	0.26	1.50
Bio. 9	Complete	White Tanna	32	70	0.36	1.29
Bio. 9	No potash	White Tanna	35	38	0.41	0.61
Bio. 9	No phosphate	White Tanna	20	68	0.31	1.31
Bio. 9	Complete	BH.10 (12)	7	40	0.39	1.16
Bio. 9	No potash	BH.10 (12)	7	25	0.40	0.54
Bio. 9	No phosphate	BH.10 (12)	3	34	0.33	1.20

The outstanding point shown by these results is the big variation in the composition of the juice derived from the two varieties, White Tanna and BH.10 (12) in Trial Bio. 9. This wide variation is one of the chief disadvantages to the use of juice analysis for diagnostic purposes, as the normal composition of the juice of each variety must be known. Where only two or three varieties are grown, however, this difficulty is not insuperable. In this Colony, for instance, at the present time, only two varieties are very widely

grown on estate lands, *i.e.* White Tanna and BH.10 (12), each of which occupy about 40% of the total estate area, judging from recent information. Thus the juice of White Tanna canes contain nearly five times as much P_2O_5 and about twice as much K_2O as the juice of BH.10 (12) canes grown under similar conditions.

The elimination of one element from the fertiliser programme (Trials Bio. 5 and Bio. 9) has definitaly lowered the amount of that element in the juice. Indeed, this method appears to be more sensitive than that of leaf analysis in so far as the P_2O_5 content is concerned, and almost as sensitive for the K_2O content.

It is interesting to note that in Trial 69, in which the effect of heavy fertiliser applications is compared to that of low applications (ratios 4 to 1) the amount of P_2O_5 in the juice from the low fertiliser plots is slightly higher than in that from the high fertiliser plots, and this difference has been noted in previous years. This is undoubtedly due to the interaction of the other fertilisers, the heavy fertiliser plots having outyielded the low fertiliser plots by over 10 tons per arpent, i.e. an increase of about 60%. This increased yield was attended by a large increase in the amount of K_2O in the juice.

The possibility of increasing the amounts of P_2O_5 and K_2O in the juice by means of heavy fertilisation may be of importance in providing planting material for new plantations in view of the results obtained by the Botanist respecting an early supply of plant foods for germinating cuttings, in order to get a better and stronger stand of plants.

EXPERIMENTS ON SMALL PLANTERS' LANDS

Experiments have been continued in the Lallmatie and Solferino areas, with the main object of discovering one or more varieties of high quality capable of replacing the Uba de Rich Fund varieties, which are so widely grown in these areas, particularly in the former. In these areas, where the soil is extremely thin, and lacking in readily available plant food constituents, it is felt that the question of replacement of these varieties is very closely connected with the cultural and fertiliser methods employed by the small planters, and that until some improvement is effected in these methods, there is little hope for the better varieties to succeed. Consequently the whole question is being investigated as a whole, under the direction of the Senior Chemist, but close touch is maintained with the Geneticist on the question of varieties.

Four small demonstration plots were laid down during the crop season of 1937 at Belvedere (Lallmatie C.C.S.), Bon Accueil (N.E. Bon Accueil C.C.S.). St. Julien d'Hotman (St. Julien C.C.S.) and at Solferino (Mr. G. Creigh), Three of these were reaped at the end of the 1938 crop, the canes from Belvedère and Bon Accueil being weighed, but in the trial from Solferino weights were not taken.

Trial for Lallmatie C.C.S., at Belvedere

This trial contained four small plots each containing 28 stools of the three varieties M. 27/16, M. 108/30 and POJ. 2727. Two plots of each variety received nitrogenous and potassic fertilisers only in addition to pen manure (the usual treatment given to canes in this area judging from information received from the small planters), whilst the other two plots of each variety received 300 kgs. of phosphatic guano in addition to the above treatment,

The plot was reaped at the age of 13½ months and gave the following results :—

RESULTS OF DEMONSTRATION PLOT FOR LALLMATIE C.C.S.
(IN TONS PER ARPENT)

	N.P.K. plots	N.K. plots (No P_2O_5)	Average for all plots
M. 27/16	23.6	17.2	20.4
M. 108/30	19.7	16.2	18.0
POJ. 2727	17.8	12.5	15.2
Average for all varieties ...	20.4	15.3	Gen. Mean 17.9

In the virgin crops, therefore, M. 27/16 has given the best results, but it is too early to make any definite recommendations with respect to variety. The response to phosphatic guano is, however, most marked ; those plots having received this fertiliser have outyielded the others by about 33%.

DEMONSTRATION PLOT FOR N.E. BON ACCUEIL C.C.S.

This plot was similar in design, save that each plot contained 54 stools, and the varieties included in the trial were M. 108/30, M. 140/31 and POJ. 2727. The trial was harvested at the age of 13½ months, and gave the following results :—

RESULTS OF DEMONSTRATION PLOT FOR N.E. BON ACCUEIL C.C.S.
(IN TONS PER ARPENT)

	N.P.K. plots	N.K. plots (No P_2O_5)	Average for all plots
M.108/30	15.6	10.3	13.0
M.140/31	11.4	7.5	9.5
POJ.2727	14.3	9.1	11.7
Average for all varieties	13.8	9.0	Gen. Mean 11.4

The yields in this plot are seen to be extremely low but once again the effect of phosphatic guano is very marked, the N. P. K. plots having given a yield of more than 50% over that of the N. K. plots.

The trial at Solferino was situated on a very uneven piece of land, and there was only one plot of each variety, containing three rows of about 40 stools. To a strip across the plots, phosphatic guano was applied, and the varieties included M. 27/16, M.13/18, M.108/30 and POJ. 2727. Regular observations showed that the part having received phosphatic guano made the best growth, and the variety which showed up best was M.13/18, followed by M.27/16 and POJ. 2727 which were about equal.

In the trial at St Julien d'Hotman, which is due to be cut early in the crop 1939, present indications are that the phosphatic guano will show a big response and that the best variety will be M.13/18, followed by M.27/16 and POJ. 2727.

On the basis of these results, the Agricultural Instructors have been requested to urge upon all small planters the necessity for phosphatic guano and the benefits they are likely to gain from its use. It is very gratifying to be able to record that in several instances, small planters are beginning to use this fertiliser, and consequently some improvement in small planters' canes may be expected.

During the year, a further five plots have been laid down, three in the neighbourhood of Belvedère, one at Bon Accueil and one at Solferino. Due to the continued dry weather in the latter part of 1938, these plots are still very backward. One of the plots at Belvedere is a phosphatic trial in a field planted by Mr. R. Gunness, with M. 13/18. All the remainder of the new plots are variety plots, which include all the new S.R.S. canes, together with some of the older canes such as M. 13/18 and M.14/26. At Solferino (La Caverne C.C.S.) some plots also received phosphatic guano and others did not, and this plot is irrigated. In this plot, M. 134/32 is making remarkably good growth.

Many thousand cuttings of M.27/16 have been distributed in these areas through the Co-Operative Credit Societies, an essential condition being that phosphatic guano must be used at the plantation. To ensure this, whenever a member received cuttings, he also received from the Society sufficient phosphatic guano to apply at the rate of 200 kgs per arpent.

Further plots are under consideration and it is hoped to plant some Grande Saison plots in the near future, as all the plots up to the present have been in Petite Saison canes.

SURVEY OF SUGARCANE AREAS

The sugarcane areas in Mauritius may be divided into three categories i.e. estates with mills, estates without mills and Big Planters, and thirdly Small Planters' holdings. The division between the two latter categories is somewhat indefinite, as there is no strict definition of the small planters.

A general survey of the sugarcane areas was undertaken to indicate roughly the distribution and area planted by the three above mentioned categories, and maps have been prepared showing the approximate areas planted by each. This was done by visits to all estates and to many big planters, from whom information was obtained about small planters' lands.

At the same time, the opportunity was taken to get information from as many sources as possible of the following points:

(*a*) Manurial and fertiliser programmes.

(*b*) The distribution of mature and immature soils.

(*c*) The varieties cultivated.

The distribution of mature and immature soils in the area situated in the north of the Island wherein the possibility of irrigation from La Nicolière is being investigated will be continued in 1939, to gain some information as to where irrigation water can most economically be applied.

From information received, it would appear that the two cane varieties White Tanna and BH.10 (12) now occupy about the same area of estate lands, namely nearly 40% of each. On estates without mills and big planters' lands, White Tanna is more widely grown than BH.10 (12), the percentage grown being roughly 50% and 30%, respectively. Small planters, however, still seem to rely chiefly on White Tanna, together with some older varieties like 55.P, 131.P, D.109, etc.

WORK BY ESTATE CHEMISTS

Mr. G. Ducray, Chemist of Queen Victoria S.E. continued his work with respect to the plant food requirements of the soils from two estates, *i.e.* Queen Victoria S.E. and Constance S.E.

Mr. F. Robert, Chemist of Bel Ombre S.E., performed similar work to the above with soils from Bel Ombre S.E.

MANURIAL TRIALS

A short account is given of the manurial trials reaped during the year and in some of these trials highly significant differences in yield have been noted. Another important effect noticed in two trials—Bio. 5 and Bio. 9—was the effect of potash upon the sucrose content of the canes.

Trial 69

This trial, conducted at the Central Experiment Station, Réduit, consists of a direct comparison between two levels of fertiliser application, the "B" plots receiving exactly four times as much as the "A" plots. The experiment was laid out on an alternate strip plan, the variety being M. 27/16.

In 1938, it was reaped in 3rd ratoons at the age of 12 months, with the following results :—

Treatment	Yield of canes in tons/arpent	Sucrose % cane
A. Small dressing of complete fertiliser ...	13.2	14.8
B. Heavy dressing of complete fertiliser ...	28.2	15.0

This trial has now been uprooted, and in the four crops reaped, the B plots have yielded nearly 55 tons of cane more than the "A" plots, the average yields being 32.4 and 19.2 tons per arpent, respectively. This increase in yield certainly justifies the expenditure incurred in this field of low fertility and in the relatively dry climate of Réduit, and furthermore, it will be seen that the B plots are still giving satisfactory yields. Consequently it is safe to assume that the method of fertilising used in the B plots would delay the time of replanting, with a consequent reduction in cost of production.

Once again some border effect is apparent in the outside rows of the A plots, but the yield of the rows next to the outside ones does not appear to be affected. It must be remarked, however, that the yield of the B plots is about 66% higher than that of the A plots, so that it seems unlikely that the border effect in trials where the difference may amount to 25% only will be of any great magnitude.

Trial 70

This trial conducted at Bel Air-St. Félix S. E. with the variety B.H. 10 (12) on a randomised block lay-out with four repetitions, was reaped in 3rd ratoons at the age of 13 months, with the following results :—

Calculated Results of Trial No. 70

Series	Treatment	Yield in tons/arpent	Sucrose % cane
1.	Nil	22.1	18.1
2.	Complete N.P.K.	25.8	18.4
3.	P.K. no nitrogen	23.3	18.4
4.	N.P. no potash	23.7	18.0
5.	N.K. no phosphate	26.6	18.5
6.	Complete N.P.K., but F.Y.M. was applied to virgin crop ...	28.7	18.2
	Significant difference (20 ; 1) ...	2.8	...

In both the first and second ratoon crops, series (6) gave a slightly higher—but not significantly different—yield than did series (1), the only difference in treatment between these two series being that series (6) received pen manure in the virgin crop whereas series (1) did not. In the 3rd ratoon

crop, series (6) has again given a higher yield than series (1), the difference having just reached the necessary level for significance. Consequently it would appear that the application of pen manure made in the virgin crop is still exerting an effect upon growth.

The omission of nitrogen from the fertiliser treatment (series 3), has resulted in a diminution in yield but not sufficiently great to be considered significant. Similarly the omission of potash has caused a slight lowering of yield, whereas the omission of phosphate has apparently been without effect.

The reduced sucrose content in the canes from series 1 and 4 (to both of which no potash was added) may be worthy of note, as in other trials it will be seen that the omission of potash has resulted in a lowered sucrose content.

Trial 72

This trial was conducted at Beau Bois, St. Aubin S,E., on a randomised block lay-out, with five replications, with the variety BH. 10 (12.) The 2nd ratoon crop was cut at the age of 11 months, with the following results :—

Series	Treatment	Yield of cane in tons per arpent	Sucrose % cane
1	In previous crops this series received no fertilisers, but for 3rd ratoons received complete (N.P.K.) fertilisers as treatment 3	26.6	16.0
2	Complete (N.P.K.) estate practice ...	29.0	16.0
3	Complete (N.P.K.)	27.5	15.7
4	P.K. (no nitrogen)	26.8	15.7
5	N.K. (no phosphate)	24.7	15.7
6	N.P. (no potash)	28.2	15.7
	Significant difference (20.1) ...	3.0 tons per arpent.	

In the two previous crops, series (3) had given a significantly higher yield than series (1). The application of complete artificials has resulted in the yields from the two series being practically equal, and consequently the residual effect of the previous fertiliser applications to series (3) is of little account. The omission of phosphates from the fertiliser programme has caused a bigger decrease than the omission of either nitrogen or potash, the decrease just failing to reach significance.

Trial 92

This trial was conducted at St. André S.E. under irrigated conditions on a randomised block lay-out with four replications with the variety POJ.2878. The second ratoon crop was cut at the age of 10 months with the following results :—

Series	Treatment	Yield in tons of cane per arpent
1	N.P.K. (straight fertilisers) Pen manure to virgin crop in one application	25.6
2	N.P.K. (straight fertilisers) Pen manure to virgin crop in two applications	27.2
3	N.P.K. (straight fertilisers) No pen manure to virgin crop	25.0
4	N.P.K. (concentrated fertilisers) No pen manure to virgin crop	27.1
	Significant difference (20:1)	2.1 tons per arpent.

There is on the whole no difference between series (1) and (2) on the one hand and series (3) and (4) on the other, so that the pen manure applied to the virgin crop does not seem to have affected the 2nd ratoon crop. The difference between series (3) and (4) may be significant, but in the 1st ratoon crop series (3) was very slightly higher than series (4), so that this result should be regarded with reserve.

Trial Bio. 5

This trial was conducted at the Central Experiment Station, Réduit, on a randomised block lay-out with four replications, with the variety BH.10 (12). It was reaped in 1st ratoons at the age of 13½ months, with the following results :—

Series	Treatment	Yield in tons of cane per arpent	Sucrose % cane
1.	Complete artificials (N P.K.) ...	33.2	16.6
2.	N.P. (no potash) ...	26.2	16.0
3.	N.K. (no phosphate) ...	24.7	16.8
Significant difference (20 : 1)		5.7 tons per arpent.	

The omission of either potash or phosphate from the fertiliser programme has resulted in a significant reduction in yield, the reduction being greater when phosphate is omitted than when potash is.

Another important point in this trial is the reduced sucrose content of the canes derived from the no-potash plots. This was also noticed in the previous crop, but it was not mentioned as it was thought that it might be due to sampling errors. In the present crop, however, the sample was taken with great care and the sample was larger than usual, and consequently the results herein reported should be of greater accuracy. This effect of potash, which will also be noticed in Trial Bio. 9 later, on sugar cane, is in keeping with its effect upon other crops, where it has been shown to have a definite effect upon carbohydrate accumulation, by increasing the efficiency of the leaf. Thus, if the results had been calculated on a basis of sucrose per arpent, the yield from the no phosphate and no potash plots would have been almost equal.

Trial Bio. 6

The details of this trial respecting the layout, etc, were given in the Eighth Annual Report, to which reference should be made.

It is a small sub-soil experiment, conducted on a randomised block lay-out, with five replications, with the variety BH.10 (12). The first ratoon crop was reaped at the age of 12½ months with the following results :—

Series	Medium	Treatment	Yield in kgs of cane per plot	Sucrose % cane
1	Soil only	... N.K. (no phosphate) ...	49	15.8
2	Soil only	... N.P.K. (complete artificials) ...	73	15.3
3	Soil-Subsoil	... N.K. (no phosphate) ...	64	15.6
4	Soil-Subsoil	... N.P.K. (complete artificials)	67	15.3
5	Soil-Subsoil	... N.P.K. (complete artificials) ...	58	15.7
		Pen manure applied to virgin crop		
6	Sub-soil only	... N.K. (no phosphate) ...	32	15.5
7	Sub-soil only	... N.P.K. (complete artificials) ...	47	15.0
8	Sub-soil only	... N.P.K. (complete artificials) ...	66	15.1
		Pen manure applied to virgin crop		
Significant difference (20 : 1) ...			... 16.5 kgs per plot	

Each small plot only consisted of three stools of canes, and consequently the experimental error is high. However, the results obtained from the 1st ratoons tend to confirm the results obtained the virgin crop. The results obtained in the soil-subsoil mixtures are somewhat abnormal, but this is probably due to the small size of the plots. The residual effect of the pen manure applied to series (8) in the virgin crop has resulted in a significant increase over series (7). The yield of series (8) is nearly the same as series(2), which shows that with proper treatment the sub-soil can be made productive.

Trial Bio. 8

This trial, which is to test the relative efficiency of different forms of phosphate, was conducted at Bel Ombre S.E. on a randomised block lay-out with four replications with the variety B.H. 10 (12). It was reaped at the age of 12½ months in 1st ratoons, but in view of the fact that once again there was no significant difference between the plots which received phosphates and those which did not, no deductions could be drawn as to the efficiency of the different forms of phosphate and therefore the results are not given in detail.

Trial Bio. 9.

This trial was conducted at Cascade, Rose Belle S.E. in a district with the extremely high rainfall of over 125 inches per annum. The soil in this area is composed of a mature laterite with a high degree of laterisation, and is therefore acid in character, and normally low in readily available potash and phosphate. Two varieties, White Tanna and B.H. 10 (12) were included in the trial which was laid down on the plan given below :—

Plan of Trial Bio. 9

—P	C	—K	—P	C	—K	—P	C	—K
B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna	B. H. 10(12) / W. Tanna
—K	C	—P	—K	C	—P	—K	C	—P
W. Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)	W, Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)	W. Tanna / B. H. 10(12)

Each complete plot contained 7 rows of White Tanna and 7 rows of BH. 10 (12) 115 french feet in length, and consequently each plot of BH. 10 (12) or of White Tanna was 0.10 arpent in area.

The amounts of plant foods given to the different plots are as follows :—

C. plots	—P. plots	—K. plots
37 kgs. ammoniacal N.	37 kgs. ammoniacal N.	37 kgs. ammoniacal N.
38 kgs. nitric N.	38 kgs. nitric N.	38 kgs. nitric N.
120 kgs. P_2O_5		120 kgs. P_2O_5
75 kgs K_2O	75 kgs. K 0	

The fertilisers were applied at three times. The trial was planted in November 1936 and reaped as virgins in October 1938, and consequently was 23 months old at reaping. Periodical inspections of this trial revealed extreme variations in the growth of the canes in the differently treated plots, and at one time it almost appeared as though there would be an almost total crop failure in the no potash plots. Not only were the plants extremely stunted in growth, but their whole appearance indicated a severe plant food deficiency. In many cases the mid-ribs turned purple, whilst there was premature withering and browning of the leaf tips and margins, and leaf spotting due to Helminthosporium sp. seemed much more abundant in those plots than in those which had secured potash. Indeed the bronzed aspect of the no-potash plots was easily discernible from a distance. These points are being further investigated by the Plant Pathologist of the Department of Agriculture and by the Botanist of the Sugarcane Research Station. At no period was any real difference noted between the plots receiving complete artificials and those receiving no phosphate.

The calculated results are given below.

CALCULATED RESULTS OF BIO. 9

Series	Treatment	Tons of cane per arpent		Sucrose % cane	
		White Tanna	BH.10 (12)	White Tanna	BH.10(12)
1	N.P.K. (complete fertilizers) ...	33.9	38.4	14.7	14.3
2	N.K. (no phosphate) ...	33.5±5.0	37.8±6.5	14.9	14.6
3	N.P. (no potash) ...	12.9±2.1	18.1±0.8	12.1	12.3

These figures show that the omission of phosphatic fertilisers from the fertiliser programme has not resulted in any definite lowering of yield. A very different state of affairs however is seen in the case of the no-potash plots, where the omission of potash has resulted in a diminution of yield of more than 50%, the absolute reduction being 21 tons per arpent in the case of White Tanna and 20.3 tons with BH. 10 (12). A further important point is the reduction of sucrose content of the canes from these plots, reductions of 2.6% and 2.0% being noted respectively.

There is very little evidence of differential response by the two varieties, either in tonnage or richness of canes. Evidently, therefore, in this region generous supplies of potash are required for the production of satisfactory crops.

This trial also allows of a definite comparison between the two varieties White Tanna and BH. 10 (12). As there was practically no difference in yield between the complete fertiliser plots and the no phosphate plots, both these series were used for calculating the merits of the two varieties. The average calculated results were :—

White Tanna	...	33.7 tons per arpent
BH.10(12)	...	38.1 „
Sig. difference	...	2.2 tons of cane per arpent.

It is therefore seen that in the conditions of this experiment BH.10(12) gave a significantly higher yield than White Tanna in the virgin crop.

EFFECT OF POTASH ON SUCROSE CONTENT

As mentioned in several places in this report, potash has had an effect upon the sucrose content of the canes. It has been thought interesting to prepare the folllowing table, which shows the effect of potash on yield and richness in four trials.

	T. 70 BH.10 (12)		T. 72 BH.10 (12)		Bio. 5 BH.10 (12)		Bio. 9 BH.10 (12)		Bio. 9 White Tanna	
	Yield	Sucrose % cane	Yield	Sucrose % cane	Yield	Sucrose % cane	Yield	Sucrose % cane	Yield	Sucrose % cane
N.P.K. plots ...	25.8	18.4	27.5	15.7	33.2	16.6	38.4	14.3	33.9	14.7
N.P. plots ...	23.7	18.0	28.2	15.7	26.2	16.0	18.1	12.3	12.9	12.1
K_2O mgrs % juice										
N.P.K. plots		83		93		42		40		70
N.P. plots		49		91		28		25		38

These figures show that whenever the yield has been increased by application of potash, the amount of K_2O in the juice has been increased and also the sucrose % cane. In Trial 72 yield was not affected, and neither was the K_2O content nor the sucrose content.

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Réduit,
February, 1939.

PART III—RESEARCH BOTANY

By H. Evans

INTRODUCTION

During the last few years the Botanical Division has been engaged to a considerable extent on the elucidation of fundamental problems associated with root development in Sugarcane and the application of the results obtained to problems of practical agriculture. The investigations completed have, in fact, shed considerable light on root development, and particularly on the absorbing surface of the root system. It was reasonable to expect that correlations might be found to exist between the extent of the absorbing surface and cane growth, since both water and salts have to enter through the root system, and these factors have been generally considered as the primary factors limiting crop yield in the field. The extensive investigations on the quantitative development of the absorbing surface in ten different varieties both under the same environment and also in the major soil types of Mauritius, proved conclusively, however, that there was no correlation, when different varieties were considered, between either root-mass, total root surface or absorbing surface and the yield of cane produced. The differences in absorbing surface which did exist were of considerable magnitude, (500% or more between some varieties, as compared to calculated significant differences of 30–40% with the methods used).

While such results are disappointing, they are, in fact, of paramount importance, since they indicate the desirability of revising the almost universally held beliefs concerning the function of the plant root-system.

Other investigators have put forward similar views recently. Thus, according to Crafts and Broyer (1938), cereals grown in culture solution may produce larger root systems and more branching when aerated, but this change is not necessarily attended by an increased yield. They also concluded that when transpiration exceeds water up-take, the root tissues assume a more or less passive function.

Of considerable significance in relation to the results obtained on sugar cane in Mauritius, are the theories recently put forward by Went (1937, 1938.) By grafting seedlings of different varieties of Pea, on to the root system of other Pea seedlings, Went found remarkable differences in the growth of the scion, even when water and nutrients were not limiting growth. He came to the conclusion that in addition to the hormones which are known to function in plant growth, other specific growth promoting substances must be postulated. These substances, which he has termed "calines" are not generally manufactured in the organs in which they are subsequently utilised. Thus caulocaline, the substance controlling stem growth, is synthesized in the roots. The differences in stem growth occurring in the grafted Pea seedlings are explained by Went on the basis of differences in the caulocaline supply from the roots. He considers that other phenomena such as root stock effect are, at least partly, brought about by differences in the caulocaline forming capacity of the different root systems. The fundamental problem involved appears to be the same in Sugarcane: the data obtained appear to furnish disproof of the general thesis that the only function of the root-system is to take up salts and water. If it is postulated that the root-system of the different varieties have different capacities for the production of the substance caulocaline, controlling stem growth, then lack of correlation between other

features such as absorbing surface and cane growth would be explained. It would also explain why, *in the same variety*, cane growth is correlated with quantitative root characters, since, other things being equal, the supply of caulocaline would be proportional to root mass.

Unfortunately, it is not yet possible to test the caulocaline forming capacity of the roots in different sugarcane varieties, since the only method at present available is by grafting, which, in the case of sugarcane is not possible.

The general importance of roots for stem growth has, however, been proved by growing sugarcane cuttings in a saturated atmosphere, with and without roots. Although the cuttings from which the root primordia were removed, remained fully turgid, no shoot growth took place, whereas the development of even a few roots resulted in abundant shoot growth.

Cuttings in which the roots were not removed, grown outside under conditions of lower moisture produced vigorous shoots. The lack of shoot growth in those cuttings deprived of roots, therefore, appears to be due to some root function other than absorption of moisture and salts.

In view of the above considerations, the fundamental investigations on the root-system of sugarcane have been discontinued for the present. Investigations on the relationship of root characters to practical problems such as resistance to Phytalus have, however, been continued with satisfactory results.

INVESTIGATIONS ON PHYTALUS RESISTANCE

Progress Report.—One of the main reasons for the detailed studies of the root-system of sugarcane in Mauritius was concerned with the determination of what root characters constitute resistance to Phytalus Smithi (Arrow). It was thought in the first instance that a strong vigorous root-system would constitute resistance, since it appears obvious that a massive root-system would withstand the depredations of the larvae better than a comparatively restricted system. A survey of the root-system of most of the varieties grown in Mauritius enabled the selection of the vigorous types, and on this basis seedlings of POJ. 2878 × Uba Marot were recommended for Phytalus infested areas. These seedlings have, in fact, been proved to have considerable resistance, but when the comparison was pushed further it was found that there were too many exceptions to enable the supposition that phytalus resistance depends on the vigour of the root-system to be substantiated. Thus the noble varieties BH. 10 (12) and White Tanna were shown to have vigorous and extensive root-systems but showed relatively little resistance to the pest, whereas varieties like POJ. 2878, with smaller root mass resisted to a considerable degree. Attention was then directed to the nature of the roots, examination having shown that the thicker, vertically penetrating buttress roots often survived phytalus attack to a greater extent than the superficial roots. In the examination of root-systems on badly infested land stools were found which were kept alive exclusively by buttress roots. It was found that varieties such as Uba, POJ. 2878 and POJ. 2878 × Uba Marot seedlings had a greater proportion of these buttress roots than varieties such as BH. 10 (12) and White Tanna. The number of buttress roots thus appeared to be more strongly correlated with resistance than the total mass of the root-system. Experience gained by planters, however, showed very unexpectedly that the local seedling variety M.27/16 was resisting Phytalus to a marked extent, and giving considerably better yields than White Tanna and BH. 10 (12) under such conditions.

Although M.(27/16) has a vigorous root-system it is by no means outstanding either as regards root mass or the number of buttress roots.

In the meantime methods were worked out for the calculation of the root-hair surface, which is a close approximation to the actual surface of the root-system which is actively engaged in absorption. The surprising result was established, beyond all doubt, that in different varieties there was no correlation between root mass and the extent of the absorbing surface, owing to the great differences in root hair density on the roots of different varieties. Thus for the same root mass one variety might have an absorbing surface several times as great as another. It appeared reasonable to expect that the lack of correlation between root mass and Phytalus resistance would be explained by the differences in the efficiency of the root-system in absorption. This supposition was supported by preliminary determinations where it was shown that the variety POJ. 2878, known to be fairly resistant to Phytalus, had a much lower root mass than BH. 10 (12) and White Tanna, but nevertheless, had a much larger absorbing surface. This line of research was consequently followed up in great detail, the absorbing surface of several varieties being determined at intervals through the growth cycle on several soil types. The results of this investigation established the fact that although enormous differences existed in the extent of the absorbing surface in different varieties, there was little, if any, correlation between this character and Phytalus resistance. Thus SC. 12/4 and Selangor Seedling had considerably greater absorbing surfaces than POJ. 2878 and M. (27/16); nevertheless, the latter two varieties resisted Phytalus to a much greater extent. Even POJ. 2727 which had the smallest absorbing surface of all the varieties examined, had a much greater resistance than BH. 10 (12).

From these investigations the fact appeared to be established that whatever part root-mass, depth of the root-system, number of buttress roots, and absorbing surface might play in inducing Phytalus resistance, the part was obviously a minor one.

There appeared to be two, or perhaps three, other main characters which could play a decisive part in conveying resistance, viz :—

1. The nature of the roots themselves, i.e. the degree of palatability of the roots to the larvae.

2. The behaviour of the root-system following attack, i.e. the capacity for recovery. This capacity for recovery might involve the above ground parts of the plant in addition to the root-system.

3. The growth capacity of the variety under the particular conditions, since it is conceivable that a variety might be able in virtue of rapid growth to produce a crop before the Phytalus attack began, or after it had finished, and, although suffering a severe set-back during the active feeding period, might still be able to carry its crop to maturity.

With a view to investigating these possibilities a large scale Phytalus trial was laid down, in collaboration with the Entomologist on Phytalus infested land at Cote d'Or S.E. There were eight varieties in the trial, each one being replicated twelve times, the plot size was three rows of twenty holes, the whole experiment thus covering just over two acres, including the spaces left between the blocks. The varieties included in the trial were SC.12/4, BH.10 (12), POJ. 2727, POJ. 2878, Selangor Seedling, M. 72/31, M. 73/31 and M. 108/30.

INVESTIGATION OF ROOT BEHAVIOUR

Surveys of the number of phytalus larvae were made at three intervals during the active feeding period by the Entomologist.

Examinations of the root system were also carried out at monthly intervals during the feeding season and immediately after the termination of the main attack. At the same time a detailed examination of the root-system of M. 27/16, a resistant variety and BH.10 (12) a susceptible variety was made, stools being excavated at monthly intervals. An effect simulating that of Phytalus was produced by pruning off the roots of the uprooted canes at a few inches from the stem. The canes were then placed in moist sawdust to determine the recovery powers as reflected in new root formation. A marked difference between the two varieties was established. Most of the primordia had germinated in BH.10 (12), and the recovery power was low, whereas in M. 27/16 a larger number of primordia had remained dormant, and were stimulated into germinating by the root pruning treatment. Indeed, pruning of the new roots produced caused a second batch of primordia to germinate. This work is mentioned here, since it gave the clue to the method of investigation used in the Cote d'Or trial. When the examination of the root-systems at Cote d'Or were completed, the canes were uprooted in the same manner, transported to Réduit and the root-pruning treatment applied.

The detailed description of the root systems during the period of Phytalus feeding will not be given here. It may, however, be mentioned that particular attention was paid to the number of new white roots at each examination. From this view point M.73/31, SC.12/4, M.72/31, POJ. 2878 and M.108/30 were well equipped. It was noticed, however, that in M.73/31 most of the new roots had been formed from old root bands, whereas in M.72/31, SC.12/4 and some of the other varieties they had originated from younger root bands near the soil surface. In M.108/30 and POJ. 2878 the greater number had originated from new buds and underground tillers. The number of new roots formed as a result of the root pruning treatment for each variety are given in Table I.

TABLE I

Variety	M. 73/31	M. 72/31	POJ. 2878	BH. 10(12)	SC. 12/4	M. 108/30	POJ. 2727	Selangor Seedling
June ..	116	130	51	3	7	83	42	140
July ...	74	45	11	12	4	20	15	46
August ..	100	32	35	27	40	20	35	40
Totals ...	290	207	97	42	51	123	92	226

Notes were made on the point of origin of the new roots, since it was considered that the value of the new roots would be dependent to some degree on this factor. The new roots formed were located in three positions, viz, (*a*) from ungerminated primordia in old root bands, (*b*) from new underground buds and young tillers, (*c*) from root primordia located in new (and as yet ungerminated) root bands near the soil surface. It is considered that (*a*) and (*b*) are of considerably more value than (*c*), since the latter were induced to germinate by the moist conditions in the sawdust, but owing to their not being in close proximity to the soil would not have made a considerable addition to the rootsystem in the field, unless the stool was earthed up. In M.73/31 most of the new roots were from old primordia and new tillers; in M.72/31 there was a considerable number from these sources, but also an

appreciable number from new primordia near the soil surface; in POJ. 2878, POJ. 2727 and M.108/30 the majority were from new buds and tillers, the remainder about equally produced from old primordia and new root bands; in Selangor Seedling the greater proportion was from young root bands; in S.C. 12/4 almost exclusively from old primordia, and in B.H. 10 (12) mostly from young root bands.

The important fact that sugarcane varieties hold a certain number of root primordia in reserve was thus established, and that these primordia only germinate under the stimulation provided by drastic pruning of the roots. Under the stimulus of Phytalus feeding these primordia germinate, in addition to new primordia produced on young buds and underground tillers, and, under moist conditions those primordia located in root bands near the soil surface.

The great importance of new white roots for the growth and development of sugarcane has been previously recognised both in Mauritius and elsewhere. In Mauritius, it was shown that white unsuberised roots could absorb at least five times as fast as older suberised roots of a similar length, while Venkatraman and others have emphasised the extreme importance of new roots.

It will be shown later in this account that growth during the Phytalus feeding period was directly correlated with capacity for recovery as determined by the number of new roots produced following the root pruning treatment.

THE RELATIONSHIP BETWEEN VARIETY AND DEGREE OF INFESTATION

The mean results of the Phytalus surveys carried out under the direction of the Entomologist are analysed below :—

TABLE II

Partitioning of variances	Degrees of freedom	Sum of squares of deviations	Variance	Standard deviation
Between blocks ...	11	841.4575	76.496	...
Between varieties ...	7	378.4345	54.062	...
Error	77	387.6105	5.034	2.24
Total ...	95	1607.5025	16.921	...

Variety	Mean No. of larvae	Silica, o/o dry roots
M. 73/31 ...	7.97 ...	3.10
M. 72/31 ...	11.96 ...	2.62
BH. 10 (12) ...	11.62 ...	2.35
POJ. 2878 ...	6.84 ...	3.54
POJ. 2727 ...	7.00 ...	3.24
Selangor Seedling ...	10.71 ...	2 85
S.C. 12/4 ...	10.00 ...	2.80
M. 108/30 ...	9.60 ...	2.46
Gen. Mean ...	9.44 ...	...
S.E. ...	0.65 ...	...
Sig. Difference ...	1.79 ...	...

The analysis leads to the unexpected conclusion that there is a significant difference in the number of larvae associated with each variety.

As has been stated the chief purpose of this trial from the physiological point of view was the determination of what constitutes resistance. Simultaneously with the root investigations described above, all other possible aspects of the problem were being considered. Thus anatomical studies of the roots to determine whether any large differences in root structure existed, were carried out, and also analyses of roots for sugars, total ash, and silica.

It was difficult to establish the quantitative aspects of root-structure and differences in degree of lignification, etc. were comparatively small. No relationship could be established between sugar content or ash content and resistance but the data for silica appeared to be suggestive.

On comparison with the figures for number of larvae obtained by the Entomologist (these were obtained some months after the silica analyses had been completed), a remarkably close correlation was found. The silica content is given in the above table.

The correlation coefficient between the two sets of figures is —0.918 and is fully significant. The remarkable result that the number of Phytalus larvae associated with the varieties in this trial is inversely proportional to the silica content of the roots, thus emerges. What the real significance of this result may be, it is premature to judge at this stage.*

YIELD OF CANE AT THE END OF THE FIRST INFESTATION

This trial was planted as a long season crop as this is the practice in this locality. The crop would, therefore, be subjected to a second Phytalus attack in 1939. Data on yield were required at the end of the first attack ; all the canes were, therefore, measured in September 1938. After these measurements were completed, a sample of twenty four canes of each variety (two from each plot) were cut, measured and weighed. A factor of weight per unit length was thus obtained for each variety, from which, with the total cane measurements, the yield of cane could be calculated. These yields, naturally, included tops, so that to obtain the yield of millable cane, a fourth or a fifth of the total tonnage should be deducted. The yields are given below :—

Variety	Tons p.a.	As % Gen. Mean	Total No. of new roots (from Table I)
M. 73/31	36.9	144	290
M. 72/31	29.3	114	207
M. 108/30	29.2	114	123
POJ. 28/78	23.7	92	97
S.C. 12/4	23.6	92	51
Selangor Seedg. ...	21.9	85	226
POJ. 2727	21.5	84	92
BH. 10 (12)	19.5	76	42
Gen. Mean	25.7	100	...
S.E.	0.98	3.8	...
Sig. Difference ...	2.7	10.8	...

The total number of new roots following root pruning (from Table I) are also placed in this table for comparison. It is seen that there is good correlation between the yields produced by each variety, and the total number of new roots produced as a result of the root-pruning treatment simulating Phytalus attack. The correlation coefficient is +0.76 and is fully significant.

It thus appears to be established that in this trial at least, the yield produced under Phytalus attack is proportional to the reactions of the variety as measured by its capacity for producing new roots.

* It was later found that this differential infestation was due to the adults having a preference for leaves low in silica + tending to lay their eggs in the spot where they had been feeding. It only resulted from the proximity of small plots of different varieties as

It is not known as yet, whether the high correlation between number of larvæ associated with each variety and the silica content of the root, means that high silica content can protect the roots from attack. Experiments to test this point by attempting to increase the silica content by applications of soluble silicate are contemplated.

CORRELATION BETWEEN YIELDS PER BLOCK, AND PHYTALUS NUMBER PER BLOCK

The mean number of larvae per block varied from eight to eighteen thousand per acre. The correlation between yields per block and number of larvæ was low,—0.41, though a real one. It must be concluded, therefore, that differences in soil fertility between blocks was of considerable moment even when compared with such differences in the number of larvæ.

This result is of interest in the light of root-pruning experiments carried out at Réduit where Phytalus is absent and where it was shown that during the winter months when moisture is abundant one-half or more of the root system could be removed without resulting in any wilting of the plants. From these facts, the writer is of opinion that in the wet districts where Phytalus infestation is rather low, the effect of the pest in reducing yields is effected more by cutting down the supply of nutrients than by cutting down the supply of water. The soils in these regions are naturally poor, owing to leaching, and a marked reduction of the root system would be expected to accentuate the natural poverty of the soil. If this view is correct, the depressing effect of Phytalus could be to a large degree offset by increasing the fertiliser applications in the form of small but frequent applications during the feeding period.

VARIETAL SUITABILITY FOR PHYTALUS REGIONS

The yields obtained at 12–13 months in this trial would have justified the harvesting of a short season crop. During the dry months of September to December, 1938, the variety M.73/31 which appeared to have been the best Phytalus resisting cane of the varieties tested suffered to a remarkable extent from red-rot following borer attack, to which it appears to be extremely susceptible. Harvesting the trial as a short season crop would probably have avoided this, but in the present circumstances it is doubtful whether M 73/31 will be able to regain the lost ground before the next harvesting season.

Recommendations as to which of the varieties tested should be grown in Phytalus regions, must, therefore, be postponed, until further data are available, not only for the varieties included in this trial but for all the new seedling varieties which are now under trial on Phytalus land at Colmar, Britannia S.E.

In the latter locality, a similar trial to that laid down at Cote d'Or S E., has been laid out in collaboration with the Entomologist and Geneticist. The varieties include all the new seedling varieties M.108/30, M.171/30, M 72/31, M 73/31, M.134/32 and M.168/32, and, in addition, the varieties POJ.2727, POJ.2878, M.27/16, M.14/26, S.C.12/4, St. Felix, and S.A.3. It is proposed to attempt to evaluate the factors affecting borer resistance as well as Phytalus resfstance in this trial.

SOME FURTHER OBSERVATIONS ON DROUGHT RESISTANCE

Previous work was concerned mainly with the part played by the root system in drought resistance, though measurements of total leaf surface were also made. Some observations were made during the year, on the rate of transpiration per unit leaf area, and on the relationship between the stomatal density and water-loss. There was no correlation between the stomatal density and the rate of transpiration, S.C. 12/4 for instance, having double the density of stomata occurring in POJ. 2727, but with a considerably smaller transpiration rate.

The method of measuring water loss which gave the most uniform results was that in which several leaves of the same rank (4th leaf from apex) were removed, weighed immediately, and left to hang in still air, the weight being recorded at intervals. By this method considerable differences in the rate of water-loss from the leaves of different varieties were established. The results of a typical experiment are plotted in Fig. I.

The rate of water loss was correlated to a considerable extent with the degree of curling of the leaves. Those varieties which lost least water during the twenty four hour period, showed leaf-curling much earlier than the remainder. In this respect, the control was most sensitive in S.C 12/4 and BH. 10 (12). It is probable that such leaf curling plays an important part in nature.

The root pruning technique accompanied by growth measurements as previously described (Bull. 14, S.R.S., Mauritius) appears to give a close indication of the drought resisting powers of different varieties. In a further experiment of this type six stools of each of the following varieties were treated: M.72/31, M.73/31, M.108/30, M.171/30, M.167/32, M.168/32 M.140/31, M.134/32, BH.10(12) and M.27/16. No such marked effect involving wilting and yellowing and subsequent withering of the leaves as was observed in previous experiments was observed. This was probably due to the more viable condition of the stools. Nevertheless, there were considerable differences in the growth rate (as compared to untreated stools) between the different varieties. The only varieties that grew appreciably following the treatment were M.108/30 and BH.10(12); (M.134/32 also grew appreciably, but having been planted about 3 months later, it cannot be directly compared with the other varieties). M.72/31 showed a smaller, but significant growth increment during the period of the experiment. The other varieties did not show a significant growth increment: M.73/31 actually showed a decrease owing to the death of some canes.

The order of merit was therefore as follows:—

M.108/30
BH.10(12)
M.134/32 (?)
M. 72/31
M.171/30 ┐
M. 27/16 │
M.167/32 } No significant growth increment.
M.168/32 │
M.140/31 ┘

M.73/31—Significant growth decrement.

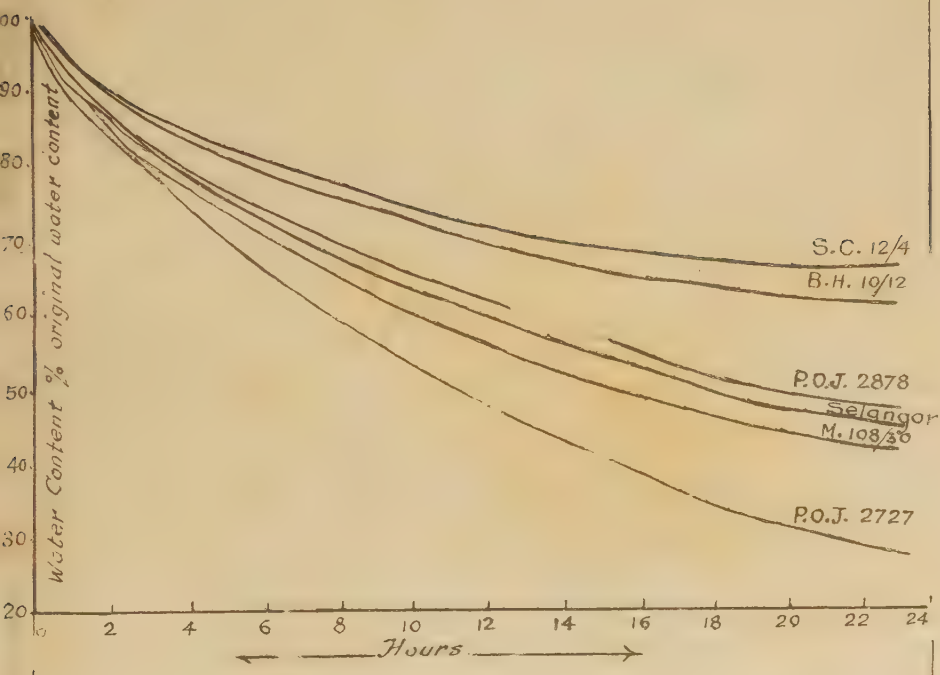
Water Content % original water content
90
80
70
60
50
40
30
20
0
2
4
6
8
10
12
14
16
18
20
22
24
Hours
S.C. 12/4
B.H. 10/12
P.O.J. 2878
Selangor
M. 108/30
P.O.J. 2727

Fig. I

It appears, therefore, that with the possible exception of M 108/30, there is not one variety in the series tested, which is superior to BH.10(12) in its drought resisting ability.

POT EXPERIMENTS ON THE TIME OF APPLICATION OF NITROGEN, POTASH, AND PHOSPHATE TO SUGARCANE

An experiment has been carried out to determine the influence of time of application of the three major plant nutrients on tillering and growth of sugarcane, particularly in the early stages. The plants were grown in 22 gallon-drums, filled with an average Reduit soil. There were 25 units in each experiment, making 75 in all. They were laid out in three 5 × 5 latin squares. The total dressing per drum was 100 grams sulphate of ammonia (300 kgs per acre), 66 7 grams phosphatic guano (200 kgs per acre) and 26.7 grams potassium sulphate (80 kgs per acre). The nitrogen, potash and phosphate were applied (A) at planting, (B) at 3 months, (C) at 6 months and (D) in three equal doses at each of these periods, respectively; and controls (E), with one fertiliser missing. Each experiment to test one fertiliser was given full doses of the two remaining fertilisers. The results are briefly considered below :—

NITROGEN

TABLE I—EFFECT OF TIME OF APPLICATION OF NITROGEN

	A	B	C	D	E	Gen. Mean	S.E.	Sig. Diffc.
Tillers								
3 months ...	3.2	1.6	1 4	2.8	1.6	2.12	0.45	0.98
6 months ...	4.2	8.8	1.4	5.2	1.8	4.28	0.44	0.96
8 months ...	4.2	8.2	1.8	5.0	1.8	4.20	0.55	1.20
Length of shoots (cms)								
3 months ...	43.6	36.6	21.4	40.2	23.2	31.0	71.8	15.6
6 months ...	152.0	164.0	59.8	150.8	66.8	118.7	9.0	19.6
8 months ...	173.2	182.8	71.2	165.4	76.0	133.7	10.2	22.2
Wt. of shoots (grms.)								
8 months ...	1,024	923	493	1,117	504	816.4	55	120

Under the conditions of this experiment an application of nitrogen at planting caused an almost immediate increase in tillering and growth of the shoots. The whole application at three months, however, resulted in much more prolific tillering than either an equal dressing at planting or a divided dressing. This effect may be associated with the development of the plants, or with the high temperatures obtaining at the time of the 3 month application, or most probably with both factors. There was no appreciable difference in the total length of shoots at eight months, but the weight of shoots was still greater in those which had received some nitrogen at planting, the partial doses (D) being almost significantly better than all at planting (A), and significantly better than the 3 month application (B). Growth of the plants completely ceased at about 8 months, so that the experiment had to be discontinued, and thus data on the effect of the later applications could not be obtained. This growth stoppage was proved to be due to lack of new root formation, and occurred also at about the same time in the potash and phosphate experiments.

POTASH

TABLE II—EFFECT OF TIME OF APPLICATION OF POTASH

Tillers,	A	B	C	D	E	Gen. Mean	S.E.	Sig. diffce.
3 months ...	3.8	2.4	2.4	4.2	3.6	3.28	0.43	1.32
6 months ...	4.8	5.8	3.8	5.4	3.8	4.72	0.48	1.48
8 months ...	5.2	6.0	3.6	5.2	3.8	4.76	0.39	1.2
Length of shoots (cms.)								
3 months ...	37.0	28.2	25.2	48.0	33.2	34.2	6.5	14.0
6 months ...	145.0	111.4	79.8	158.8	92.2	117.4	11.6	35.7
8 months ...	160.4	153.0	87.2	171.8	101.8	128.8	13.1	40.5
Wt. of shoots (grms.)								
8 months ...	1,114	633	652	891	593	777	29	90

Under the conditions of the experiment, the effect of potash, though not significant in the early stages had become fully so at 6–8 months. Potash caused an increase in the number of tillers, and in the length and weight of shoots. There was no significant difference in the number of tillers or in shoot length between those which received their potash at planting, at three months, or in divided doses, but with respect to weight of shoots the application at planting was superior.

PHOSPHATE

TABLE III—EFFECT OF TIME OF APPLICATION OF PHOSPHATE

Tillers,	A	B	C	D	E	Gen. Mean	S.E.	Sig. diffec.
3 months ...	4.0	2.0	1.0	2.6	1.0	2.04	0.39	1.2
6 months ...	4.4	3.4	2.8	5.0	1.0	3.32	0.60	1.85
8 months ...	4.6	3.4	2.6	5.0	1.0	3.50	0.61	1.85
Length of shoots (cms.)								
3 months ...	44.8	8.0	10.2	33.8	8.0	20.9	4.71	14.5
6 months ...	148.0	56.8	39.4	114.6	26 8	82.9	11.7	35.9
8 months ...	161.4	66.0	50.0	154.6	33.0	93.0	11.8	29.2
Wt. of shoots (grms.)								
8 months ...	1,014	376	322	971	249	586	71	219

The response to phosphate under these conditions was much greater than to either nitrogen or potash. The application of some, or all, of the phosphate at planting was definitely superior to delayed application. A delay of three months caused a depressing effect which was not made good. There was no advantage in dividing the phosphate dressing and applying in more than one application.

In this experiment the leachings were returned to the drums, so that the complicating effects of leaching caused by heavy rains was eliminated. On the other hand, growth ceased and there was wilting of the plants at about eight months old. This was caused by a cessation of new root formation presumably owing to the unnatural conditions in the drums. The effect of the later applications could not thus be determined, since the plants had to be harvested at eight months. The very large effects of the various fertilisers on tillering and growth of the cane in the early stages are, however, of considerable interest.

The pot experiments have, therefore, been followed up with large field trials laid down in six localities. The trials are laid out in the form of four randomised blocks, with plots 60–80 holes long, by four rows wide. In view of the results of the above pot experiments and of the experience of most

planters, the phosphate was, in all cases applied at planting. The potash and nitrogen was applied in the following manner :

A.—All K and N at planting.
B.—All K at planting ; all N at 3 months.
C.—All N at planting ; all K at 3 months.
D.—All K and N at 3 months.
E.—1/2 K + 1/2 N at 3 months ; 1/2 K + 1/2 N at 6 months.
F.—1/2 K at planting ; 1/2 K + 1/2 N at 3 months ; 1/2 N at 6 months.
G.—1/3 K + 1/3 N at planting ; 2/3 K + 1/3 N at 3 months ; 1/3 N at 6 months.
H.—1/4 K + 1/4 N at planting ; 1/2 K + 1/4 N at 3 months ; 1/4 K + 1/4 N at 6 months ; 1/4 N at 9 months.

The results of these trials will be given in the annual report for 1939.

LEAF DIAGNOSIS

On the above trials, collaborative work between the Chemical and Botanical Divisions on leaf diagnosis is being carried out. The object of this work is to test the foliar diagnosis method not only for indicating nutrient deficiencies, but also for determining the type and quality of metabolism leading to increased yields. It is premature to draw any conclusions at this stage, but the method appears promising.

In connection with this work, the injection methods developed by Roach at East Malling Research Station are also being investigated on the advice of Sir F. A. Stockdale.

LEAF AND STEM INJECTION

It will be recalled that the stem injection methods referred to above were used as a possible means of controlling arrowing (Ann. Rep.,S.R.S., 1935). Stem injection was used in these studies, large quantities of Nitrogen and of Sucrose being introduced in an attempt to alter the Carbohydrate Nitrogen ratio. The influence of potash and phosphate and other substances was also investigated. The method was not tested for its possible use in indicating nutrient deficiencies on poor soils, however, neither was leaf injection attempted. While it is not considered that leaf injection for correction of deficiency symptoms will find wide scope in Mauritius (owing to the extreme rarity of such symptoms), stem injections accompanied by growth measurements may lead to valuable results. Nevertheless, satisfactory methods of injecting sugarcane leaves have been worked out, the course of injection being followed by the use of dyes.

Injection of the leaf tip did not result in complete injection, the whole leaf width being injected for a distance of six inches or so from the tip, though injection continued along the margin for a considerably further distance.

When the lamina was cut transversely up to the midrib at the base, and then vertically upwards for a short distance and the flap thus freed placed in the dye, injection of half the leaf occurred at the base, but the injection zone then left the midrib, and gradually tapered away at the margin.

In order to obtain complete injection of half the leaf, the method adopted was to cut transversely across the leaf, half way through the midrib, and then to slit the midrib upwards for a short distance and placing the flap thus set free in the liquid. The complete half of the leaf became injected by this method, so that the other half could be used as control. These results are in accordance with the venation of the leaf, the bundles not being strictly parallel, some of the inner bundles joining the midrib at various points along its length.

The type of injection obtained by the various methods is indicated in Fig. II.

EXPERIMENTS ON THE DISPOSAL OF TRASH

The question of the most efficient method of trash disposal is one of considerable economic importance. In Mauritius, trash is seldom or never burnt, but is usually either left on the surface on every alternate interline, or is placed in a shallow furrow, or is completely buried. Experiments have been laid out to determine the relative efficiency of the various methods in use. In view of the important results obtained recently at Rothamsted on the burying of straw with incorporated fertiliser, such treatments were also included. Three large trials have been laid down, viz at Union Park S.E., at Colmar S.E. and at Benares S.E.

Union Park Trash Burying Trial.—The treatments were as follows:—

A.—Trash buried in two furrows alongside the cane rows.

B.—Trash buried in one large furrow running down the middle of the interline.

C.—Trash buried as in (B) but with a dressing of 50 kilos of sulphate of ammonia per acre, spread on the trash before covering.

D.—Trash buried as in (B) but with a dressing of 30 kilos of nitrate of potash plus 30 kilos phosphatic guano incorporated with the trash.

E.—Controls, trash heaped on the surface of the interline.

The experiment was laid out in the form of four randomised blocks.

The plots consisted of five rows each of 200 feet (80 holes), thus including four interlines. Two of these interlines were treated in 1938, the other two will be treated in 1939. (This was to conform to the local practice of treating alternate interlines).

The treatments were effected on the 17th May, 1938, and the plots were harvested on the 17th October, 1938. The results are given below :—

Treatments	A	B	C	D	E	Gen. Mean	S.E.	Sig. Diffce.
Tons p.a. ..	19.3	20.5	19.8	19.8	19.8	19.84	0.97	2.93
As % Gen. Mean...	97	103	100	100	100	100	4.9	1.50

The treatments applied in May have thus failed to affect the yield of cane harvested in October of the same year.

Colmar S.E. Trash Burying Trial.—The treatments at Colmar were as follows:—

A.—Trash buried in two furrows alongside cane lines.

B.—Trash buried as in (A) but with 50 kilos sulphate of ammonia incorporated with trash.

C.—Trash buried as in (A) and (B) but with a mixture of 30 kilos nitrate of potash plus 30 kilos guano phosphate with trash.

D.—Trash buried in one large furrow running down the middle of the interline.

E.—Trash buried as in (D) but with 50 kilos sulphate of ammonia

F.—Trash buried as in (D) and (E) but with a mixture of 30 kilos nitrate of potash plus 30 kilos guano phosphate.

G.—Controls, trash heaped on interline.

The trial here also consisted of four randomised blocks, with plots five rows wide (two interlines, one of which was treated in 1938, the other to be treated in 1939) and 200 feet long (1/8 acre).

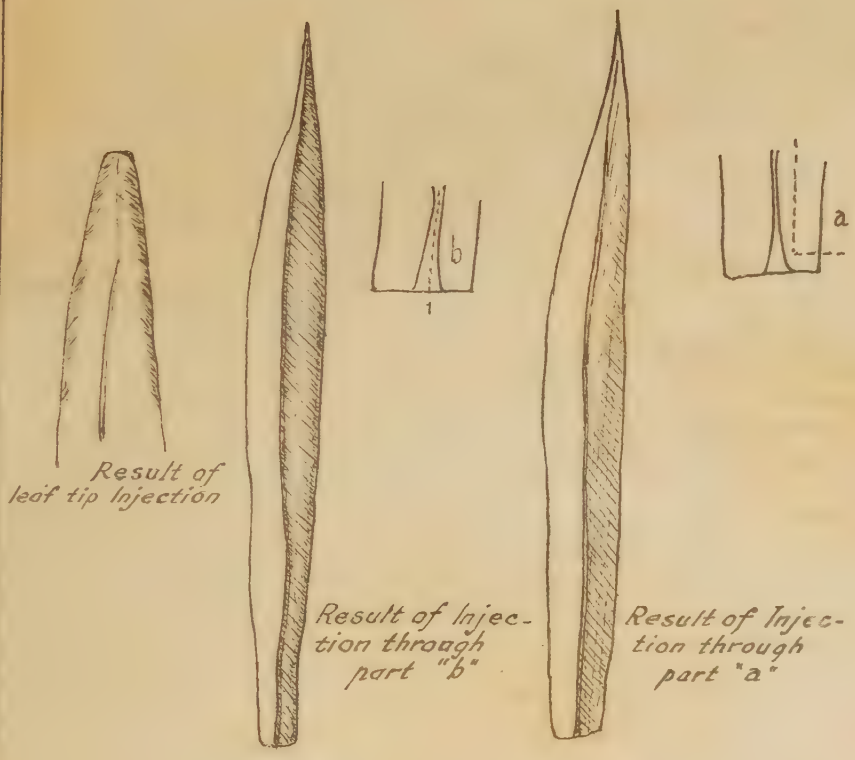
Result of leaf tip injection
b
1
Result of Injection through part "b"
a
Result of Injection through part "a"

Fig. II.

The treatments were effected on June 6th, 1938, and the plots were harvested on September 27th. The yields are given below :—

Treatments	A	B	C	D	E	F	G	Gen. Mean	S.E.	Sig. Diffce.
Yields	26.8	27.1	26.9	28.4	27.6	26.4	26.5	27.1	1.0	3.0
% Gen. Mean	99	100	99	105	102	97	98	100	3.8	11.2

As was the case at Union Park, the treatments applied early in June did not affect the yields in the current crop.

Benarès S.E. Trash-Burying Trial.—The treatments at Benarès S.E. were as follows :—

(A) Trash buried in one furrow in the middle of the interline, covered, and 100 kilogs sulphate of ammonia p.a. applied as a top dressing on the soil.

B.—Trash buried in one furrow in the middle of the interline.

C.—Trash buried as in (A) and (B) but with a top dressing of 150 kilogs sulphate of ammonia p.a.

D.—Trash buried in one furrow with 50 kilos sulphate of ammonia incorporated with the trash.

E.—Trash buried in one furrow with 30 kilos nitrate of potash plus 30 kilos guano phosphate with the trash.

F.—Controls ; trash heaped on the surface of the interline.

The lay-out of the experiment and the plot size was the same as in the Colmar experiment. The treatments were effected on Tuly 11th, 1938, and the trial was reaped November 21st, 1938. The yields wore as follows :—

Treatments	A	B	C	D	E	F	Gen. Mean	S.E.	Sig, Diffce.
Yields ...	29.3	28.3	28.4	29.0	29.9	30.5	29.0	1.05	3.11
% Gen. Mean ...	101	97	98	100	103	105	100	3.6	10.7

It may, therefore, be concluded that here also the treatments applied have had no effect on the current season's crop.

Summarising, it may be stated that burying trash either with or without fertiliser in the period May—July has no effect whatsoever on the crop of the current year. This result was not unexpected, though some planters were of the opinion that trash burial could increase the tonnage of even the crop of the current year. It is possible, however, that the treatments will show an effect on the 1939 crop. The same treatments will be applied to the interlines which were not treated in 1938, during the coming year, and the plots again harvested.

EARLY FERTILISER REQUIREMENTS OF SUGARCANE

In the 1937 Annual Report an account was given of some preliminary results on the early fertiliser requirements of sugarcane. These preliminary experiments indicated that seemingly the supply of nutrient elements stored in cuttings is not adequate for unlimited growth during the period when the young shoots are still dependent on the stored food material of the mother cutting. Introduction of a small quantity of a mixture of potassium phosphate and urea, to supply the three elements needed in greatest amounts resulted in a marked increase in growth of leaves, stems and roots.

An experiment on a larger scale was laid down at P.E.S. In this experiment there were three treatments, viz (A) 2.5 grs of a mixture (KH_2PO_4 plus Urea) placed within the cuttings ; (B) an equal quantity placed in the

hole, outside the cuttings; (C) Controls, in which none of this mixture was applied. The three treatments were otherwise treated according to normal plantation practice. The trial consisted of four randomised blocks, the plot size being 3 rows of 25 holes. Tiller counts were made when the plants were three months old, with the following results :—

	No. of tillers per plot	No as % of Gen. Mean
A ...	403.3	24 6
B ...	298.5	92.2
C ...	269.0	83.1
General Mean	323.6	100
S. E. ...	20.9	6.8
Sig. Difference	51.1	15.8

It is seen that the incorporation of fertiliser within the cuttings resulted in a marked increase in the number of tillers, since the same amount of fertiliser applied outside the cuttings was not significantly better than the controls. The preliminary experiments described in the annual report for 1937, had shown that the young shoots could mobilise the fertilisers thus incorporated in the cuttings. The yields of cane at harvest in tons per acre are given below :—

	Yields, tons/acre	As o/o General Mean
A ...	28.92	106.3
B ...	27.19	99.9
C ...	25.51	93.8
Gen. Mean	27.21	100
S.E.	1.37	5.02
Sig. Difference	4.73	17.4

The differences in yield, though failing to reach significance, are in favour of the "A" treatment. The larger difference in tiller number at 3 months, does not, however, seem to have persisted.

It appears that a much better stand would be obtained by planting cuttings rich in stored nutrient elements. This may not, of course, be achieved practically, by the method of incorporation used here. The same results might, however, be achieved by using as planting material, cuttings from cane grown on rich land. In fact, it raises the question of the desirability or otherwise of specially fertilising canes from which planting material is to be taken. Such a practice is not new in sugarcane agriculture: it has previously been suggested from India and from Cuba. In fact further results from Cuba have recently been published (reviewed in Sugar Abstracts, Facts about Sugar. Nov. 1938). Yields from well nourished "seed-pieces" were 47% greater than from inferior "seed." The final conclusions are that cuttings intended for planting should be taken from canes grown on heavily fertilised soil (complete fertiliser) and, moreover, the cuttings should be taken when the shoots are young and more heavily charged with nutrients than they will be at later stages of growth.

In comparing the results obtained in Mauritius, it should be remembered that the soil on which the experiment was carried out is naturally rich and that on poorer soils considerably greater increases might be expected. It is considered worth while to test further the efficacy of pre-fertilisation of canes for planting material.

HORMONE EXPERIMENTS

Some preliminary experiments on the effect of hormones on root formation in sugarcane have been completed. In the first series of experiments prepared cuttings were stood on their ends in large photographic dishes filled with solutions of a-naphthol acetic acid for twenty-four hours, and then planted in sawdust in the greenhouse, and root formation was compared with similar cuttings which had stood in water. An accelerating effect on root formation was recorded in the early stages (during the period 4 to 8 days after planting). Root-formation was so good in the controls, however, that they had caught up with the treated cuttings in about 14 days, and thereafter there was no apparent difference between the two treatments.

It was thought that the good conditions for germination which occurred in the greenhouse, masked the accelerating effect of the hormone treatment. A further large number of cuttings were, therefore, treated and planted out in the field, being allowed to grow to maturity to determine whether any yield increment resulted from the hormone treatment.

Cuttings were soaked in 1/5000 hormone solution, 1/10,000 hormone solution and in pure water (controls). There were six replications of plots of 24 holes (two rows of 12 holes). Unfortunately there were cyclonic rains a few days after planting, about 10 inches falling in one day, and many holes were flooded. Following this there was a drought for some weeks. As a result of this abnormal weather there was some rotting of cuttings, and considerable recruiting had to be done.

The yields at harvest were as follows :—

Treatment	Yields per plot (kgs.)
1/5000 hormone	195.5
1/10000 hormone	213.2
Water	191.4
General Mean	200
S.E.	9.4
Sig. difference	27.0

There was was no significant difference between the treatments. Following these preliminary experiments, some further experiments on the rooting effect were carried out during the winter of 1938. In these experiments whole canes with the leaves attached were allowed to stand in hormone solutions, the proprietary product Hortomone A being used. The rooting effect using this technique was much more marked than when prepared cuttings were allowed to stand in the solution. The hormone solution in this case was absorbed as a result of transpiration. Whole canes thus treated, and canes treated, but subsequently cut into single-eye cuttings, were afterwards placed in moist sacking, and compared with similar canes placed in water for corresponding periods.

The mean number of root-primordia which had germinated after two weeks in moist sacking on single eye cuttings from known positions on the cane, and the mean number per node in whole canes are given below :

	Base									Apex	Total
Position of cutting :—	1	2	3	4	5	6	7	8	9	10	
Single-eye cuttings :											
Treated ...	21	32	25	27	22	20	16	21	0	0	184
Controls ...	7	1	0	0	0	0	0	0	0	0	8
Whole canes :											
Treated ...	17	11	9	12	10	8	0	0	0	0	67
Controls ...	1	1	0	0	0	0	0	0	0	0	2

The hormone treatment thus caused a marked acceleration in the germination of roots when the canes were allowed to absorb the solution, the effect being considerably greater than when prepared cuttings were allowed to stand in the solution. It is apparent also that the number of roots germinating is considerably greater when the treated canes are cut up into setts, than when the cane is left intact. Whether this accelerated root-production would result in increased yields in the field, is, as yet, not established. It is doubtful, in any case whether such treatment could be applied on a commercial scale.

EXPERIMENTS ON THE CONTROL OF WEEDS BY CHEMICAL MEANS

An investigation on the possibility of controlling weed growth, in collaboration with the Plant Pathologist was carried out during the year at Union Park S. E. Through the kindness of the Manager a supply of sodium chlorate and other proprietary weed-killers were placed at our disposal.

The preliminary experiments were designed to determine the most economical dressing, and the influence of weather conditions. Special attention was given to the eradication of a grass locally known as " Mackay* ". This grass which is characterised by very broad leaves is an important pest on some estates , the cost of eradicating it by cultivation being in the region of Rs. 300 to Rs. 400 per acre.

Plots were treated at the rate of ½ oz, 1 oz, 1½ oz and 2 oz per square yard, applied in solution (one watering can per square yard) and also applied in the dry powdered state. The replications were both in space and in time, a series of such plots being treated weekly for five weeks, in order to determine the effect of different weather conditions. The results are briefly summarised below.

1. *Nature of weed-killer.*—In all the treatments, the sodium chlorate was superior to the other patent weed-killers† used, for the control of Mackay. The other patent weed-killers did, however, have a marked effect.

2. *Rate of application.*—The application at the rate of 1 oz per square yard both of sodium chlorate and of other weed-killers was definitely superior to the ½ oz rate. There was, however, no appreciable difference between the 1 oz, 1½ oz and 2 oz rates of application. One application of 1 oz sodium chlorate was superior to two dressings of ½ oz.

3. *Method of application.*—Application of the weed-killers in solution was very definitely superior to application in the dry state, even when the latter was followed by rainy weather.

4. *Influence of weather conditions.*—It appeared that the maximum effect of the weed killers was exerted in rainy though not too rainy, weather. Too much rain was, however, superior to no rain. Under dry or moderately dry conditions the influence of the chemicals was greater when applied in a large volume of water, (one or two watering cans per square yard) than when sprayed on the surface. It appears necessary that the chemicals should penetrate immediately to the maximum depth of the roots.

* Phylaris sp.

† One proprietary article recently tested, however, appeared to be as good as sodium chlorate. On analysis, however, the active principle was shown to be sodium chlo rate.

Nature of effect.—In a short time the broad leaves of the Mackay showed marked chlorotic streaks. These streaks subsequently spread and the part affected died. There was also a direct burning action, in which the whole leaf simultaneously wilted and withered. With ineffective doses, the grass may survive for a considerable period even though showing chlorotic streaks. The symptoms were very similar for the various chemicals used.

In all the plots treated with 1 oz or more of sodium chlorate, where the application was followed by light rains there was a complete control of the Mackay, though a few Cyperus sp. occurring in the plots were not killed. Where the applications were followed by dry weather, the plants became yellow and stunted, though they survived in this condition for some months afterwards.

In plots in which the Mackay was completely killed, no new shoots emerged, and the plots were bare of other weeds for over three months. In plots where Mackay was not completely killed, the plants were so damaged as to inhibit flowering.

6. *Economical Aspects.*—Having established the efficacy of sodium chlorate at the rate of 1 oz per square yard in the control of this grass, attempts were made to apply the treatment on a larger scale. For this purpose a siphon arrangement delivering the solution from a drum fitted on to an ox-cart was used, the solution escaping through jets in a horizontal tube five feet long closed at both ends. This method was quite effective. At a cost of approximately £ 30 per ton, the cost of sodium chlorate per acre would be Rs. 56 to 60. The cost of application would be dependent on the proximity of abundant water, and the efficiency of the method of application. The application should be carried out in the winter months July-September when light rains are prevalent, and the land should be left fallow for three months or so to allow the chlorate to be leached out, before cane is planted.

BOTANICAL EXAMINATION OF NEW CANE VARIETIES

A morphological examination of all the new varieties released by the Station since its inception and of the varieties introduced into Mauritius in recent years has been concluded. In this examination considerable attention was paid to the distribution of the hair groups (according to Jeswiet's classification) on the buds and leaf-sheaths. The purpose of this work was to have available an adequate description of newly produced varieties for purposes of identification, etc.

Papers were published in the Revue Agricole during the year.

Réduit,
February, 1939.

H. EVANS,
Botanist.

APPENDIX—LIST OF PUBLICATIONS OF THE SUGARCANE RESEARCH STATION, DEPARTMENT OF AGRICULURE.

I.—REPORTS

Report on a Visit to the Proefstation-Oost-Java in March–April, 1930 by A. Glendon Hill (out of print).
First Annual Report, 1930 (out of print).
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II.—BULLETINS

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